ADIO, TELEVISION and HOBBIES

olume 23. Number 1 April, 1961

BEWARE THE OLD PATTERN

DURING the past few weeks, the radio-TV industry in Australia has passed through a very slack period. This in itself has surprised me a lot less than the blank amazement which has been registered in many quarters at the turn of events. It may be helpful to emphasise certain basic facts, even though it may seem almost to be a statement of the obvious:

- Due largely to seasonal changes, the "normal" pattern of radio production and marketing in Australia is—**busy in winter, slack in summer.** If you want to know how slack, ask someone who worked in the trade prewar.
- These "normal" conditions have been obscured r the best part of 20 years. During the war, for example, the public ought receivers where they could, when they could, while the radio indusy concentrated on war orders, expanding rapidly in the process.

After the war, the potential market for new radio receivers and radioams was enormous, but highly artificial. A tremendous backlog of placement and new installation business had accumulated.

Just when the industry might have settled into its basic pattern, along me LP records, television and stereo with hundreds of thousands of ger buyers. How rapidly the demand was met—and how unwisely in any cases—is now a matter of history.

With the immediate demand for television and radio sets largely satisd, and facing the summer months, the emergence of the old pattern was ite inevitable. It was accentuated but not created by the credit squeeze.

With winter once again in the offing and with television opening country districts, production and sales will inevitably pick up again, but n't let's delude ourselves. We may well have to re-learn the prewar ssons of rigid economy, hard selling, and better service.

Fortunately, the industry does not need to be as much at the mercy entertainment business as it was prewar. What was once largely "radio" s now become electronics, with a potential penetration into almost every ase of modern life and work. It will be a tragedy indeed if the industry ils to realise this and settles back into the vicious pattern of **busy in inter, slack in summer.**

W. N. Williams

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392 Little Collins St. Phone 67-8131.

COVER PICTURE

Typifying the advance in Australia's capacity to supply its own needs in electronic equipment is the development by A.W.A. of a 2kW television transmitter, the first to be made here. Our picture shows the internal assembly.

Transmitters of this type will shortly be supplied for the new country stations, some of which are expected to begin operating towards the end of the year.

The left-hand cabinet contains the exciter stage (bottom) frequency multipliers (centre) and part of the final tuning circuits (top). The right-hand cabinet houses the rectifiers and control equipment.

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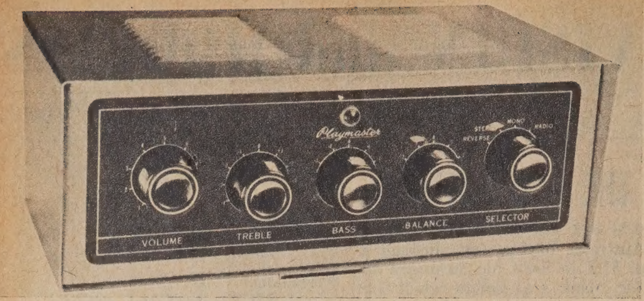

INSTROL PLAYMASTER

No. 2

14 WATT STEREO AMPLIFIER

Specifications . . .

Performance figures and circuitry used as detailed in "R., TV & H.," August, 1960. We supply best-quality components to "R., TV & H." specifications in all kits and completely built units.

POWER OUTPUT: A full seven watts per channel, rising to a maximum of eight watts per channel.

VALVES: Four—6BM8 in twin U/L output. One—12AU7 twin voltage amplifier.

RECTIFIERS: Two silicon diode 1N1763 rectifiers.

OUTPUT IMPEDANCE: 15 ohms. Others as required.

SWITCHING FACILITIES: (a) stereo: (b) stereo (reverse); (c) mono; (d) radio tuner; (e) spare.

TONE CONTROL RANGE: Treble cut and boost, 12 db; bass cut and boost, 12 db.

BALANCE-CONTROL RANGE: Equal both channels; to cut-off either channel.

INDICATOR BEZEL shows unit in operation.

FINISH: Modern metal case, seamless welded, baked enamel, beige hammer-tone, self-contained. Attractive label, coffee brown, gold lettering. Beautiful imported knobs — brown or ivory, gold centres.

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. . . and NOW

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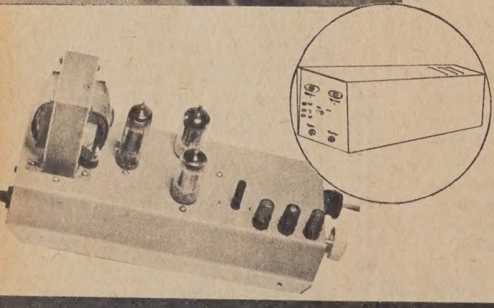
You may use them with your existing hi-fi set-up through the

STEREO HEADPHONE ADAPTER

("R TV and H." January, 1961), a plug-in unit, suitable for any make and type of amplifier, or you can invest in this "personal"



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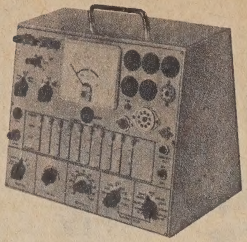
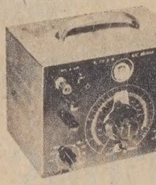
Write or call for full details.



The very latest in tester designs. The "R., TV and H." valve and transistor tester originally described in the January, 1961, issue.



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"R., TV and H.," Sept., 1958.

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3in OSCILLOSCOPE
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VALVE & TRANS. TESTER			
Metal Box and Brackets	3	7	6
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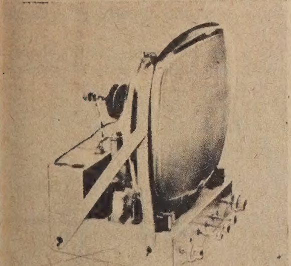

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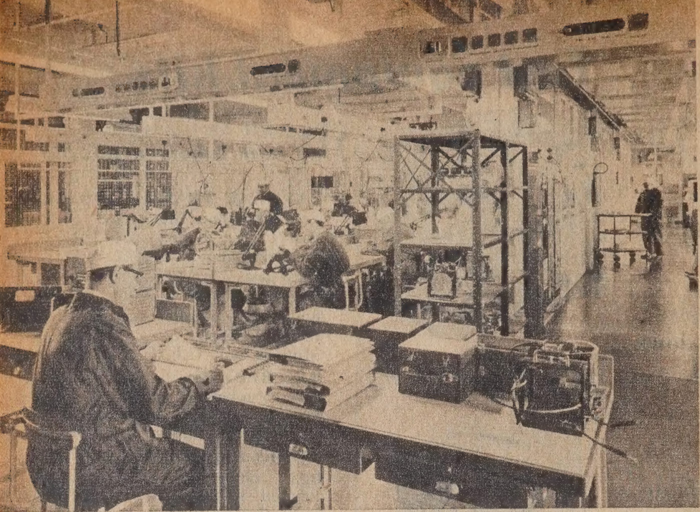


Part of the submerged repeater manufacturing unit of Standard Telephones and Cables Ltd., North Woolwich, London, which is manufacturing repeaters to be used in the Canada-Britain telephone system, due to operate in 1961.

New Techniques For Undersea Cables

Despite current speculation about communication via satellites, the success of repeater-type submarine cables since World War II has focused on them a great deal of attention. The following article discusses current techniques and, in particular, the work being done by British Manufacturers in collaboration with the British Post Office.

by W. McMillan

A NOTABLE cable system just completed from the British point of view is that between the United Kingdom and Sweden, the longest European cable of its kind.

In 1961 the biggest all-British system ever attempted will be completed between the United Kingdom and Canada and will use a single cable to give 60 simultaneous two-way telephone circuits. This is the first link in the Commonwealth round-the-world telephone cable system proposed by the Commonwealth Telecommunications Conference in London in July, 1958.

SECOND MAJOR LINK

The second part of this round-the-world system will be the Canada-New Zealand-Australia link, due for completion in 1963. Its choice for this route, some 7,600 nautical miles long, reflects the confidence placed in the British repeater and its ability to operate for many years on the sea-bed without attention.

Submerged repeaters alone make this type of communication link possible by amplifying the electrical signals on their way along the cable before they become so weak that they are indistinguishable from the background noise.

Standard Telephones and Cables Ltd. have been manufacturers of submerged repeaters in Britain for the last decade. Starting with relatively simple shallow water systems such as The Netherlands-Denmark cable, the company was chosen to build repeaters which were designed in co-operation with the British Post Office for a cable between Scotland and Norway.

British practice has always been to house the repeater in a rigid steel case with enough room for equipment which amplifies and equalises both directions of transmission on a single cable.

The practice in the United States, as on the first two trans-Atlantic cable systems (TAT-1 and TAT-2), has been to use a repeater of flexible construction which could be fed through the normal cable-laying gear. These repeaters amplified in one direction only and therefore two separate cables were needed for each system.

LESS OF A PROBLEM

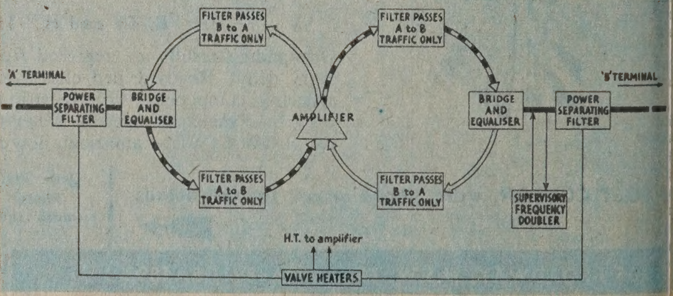
This practice is now to be altered, since the advances in cable-laying techniques have made the laying of rigid repeaters less of a problem than before. The U.S.A. repeaters which will be used on TAT-3, another trans-Atlantic cable, will be somewhat similar to the British ones, and capable of two-way amplification using a single cable.

This upsurge of activity in submarine repeatered cables prompts the questions: Why are these cables necessary, and why was the repeater not developed earlier?

The answer to the first question is that the radio links hitherto used for long-distance telephones are often subject to severe fading, sometimes making their use impossible. Again, elaborate precautions have to be taken when messages involving national security are transmitted, to minimise risk of their interception.

The radio channels used for radiotelephony have a limited available bandwidth, and demand for space in the radio frequency spectrum greatly exceeds that which is available.

With a "solid" cable circuit, there is no fading and little chance of messages being intercepted. Although the band-


FILTER PASSES B to A TRAFFIC ONLY
FILTER PASSES A to B TRAFFIC ONLY
'A' TERMINAL
'B' TERMINAL
POWER SEPARATING FILTER
BRIDGE AND EQUALISER
AMPLIFIER
BRIDGE AND EQUALISER
POWER SEPARATING FILTER
FILTER PASSES A to B TRAFFIC ONLY
FILTER PASSES B to A TRAFFIC ONLY
SUPERVISORY FREQUENCY DOUBLER
H.T. to amplifier
VALVE HEATERS

This diagram shows the paths of speech channels through a typical repeater used with notable success on new telephone systems.

idth on present cable systems is somehat restricted, the same frequency specum can be used over and over again adding further cables.

Serious work on submerged repeaters egan in the 1930s, and some experiental models were made during World ar II. The development of a long-life alve was the first objective; this inolved intensive study of the mechanical ructure of the electrodes and the ageg characteristics of the cathodes.

Not only valves, but every component nd its life and ageing characteristics ad to be examined right back from rst principles: capacitors, coils, resistors, alve sockets, wire, insulating materials, nd even metal surfaces.

'WHISKER" GROWTH

For example, the growth of "whiskers" n the metal surfaces of a repeater ould cause short-circuits. To guard gainst this possibility, all major surfaces f a repeater are gold-plated.

The results of early tests on repeater omponents confirmed that a clean, aironditioned plant was necessary for their anufacture and that an entirely new sychological approach would have to e made to meet the requirements of ong life.

In a submerged repeater, reliability nd long life must precede every other esign consideration.

To replace a faulty repeater involves he cable ship's time and lost telephone raffic revenue and it is therefore better o spend time and money on the reeaters themselves in the first instance.

In 1953, Standard Telephones and Cables Ltd. set up a special manufacturng organisation for the design, manuacture and testing of submerged reeaters at North Woolwich, London. This unit has produced more than 250 epeaters since then, and has a very full rogram ahead. Another manufacturing nit is currently being built.

Inside these workshops the work is arried out in almost clinical conditions, he operators wearing special lint-free lothing and being forbidden to smoke r eat within the work areas to ensure hat no foreign matter finds its way into ny of the components.

TYPICAL PROCEDURES

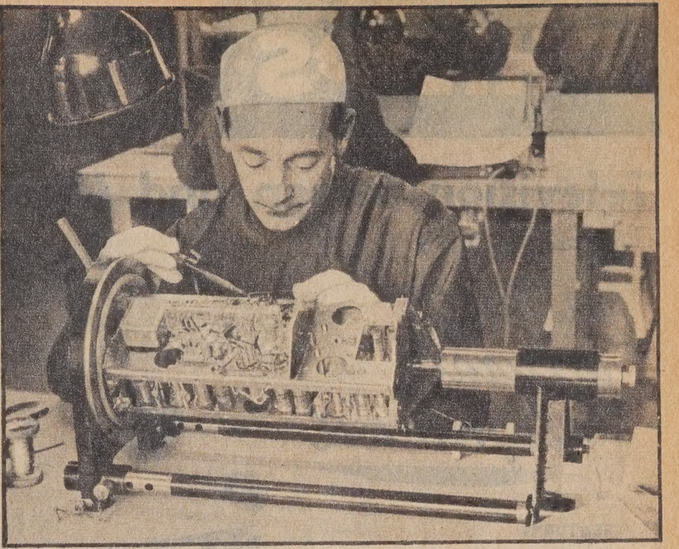
Similar conditions exist where comonents are manufactured.

Typical of the rigorous inspection proedures are the X-ray inspection of wirewound resistors and capacitors and the ndividual noise measurements on resisors while they are being vibrated. In he manufacture of coils, the insulation t the wire ends is removed electrically n an atmosphere of dry nitrogen to void oxidation.

The technique of inserting repeaters nto long telephone lines is not new: Britain's first telephone repeaters were nstalled in 1923.

Briefly, the repeater's functions are two-fold — to equalise the frequency characteristic of the received signals and to amplify these equalised signals for transmission to the next section of line.

On submarine cables it is necessary to plan the whole of the system complete, taking in the cable, the submerged repeaters, land repeaters (if any) and terminal equipment.



The operator shown here is assembling a submerged repeater-amplifier at the S.T.C. factory. Note the cap and gloves.

Having decided what is the maximum permissible noise level at the receiving end, the system plan depends upon the number of speech circuits to be sent along the cable (frequency bandwidth), the amplifier gain characteristic, the power-feeding arrangements, and the relative cost of repeaters and cable.

Present-day land trunk telephone cables are capable of handling hundreds of telephone circuits. A widely used system in Britain transmits a frequency band up to 4 Mc, accommodating 960 channels on each coaxial tube: the "go" and "return" channels are on separate tubes for simplicity. A new S.T.C. system installed in Britain and in Sweden, transmits a frequency band up to 12 Mc, equivalent to 2,700 telephone circuits.

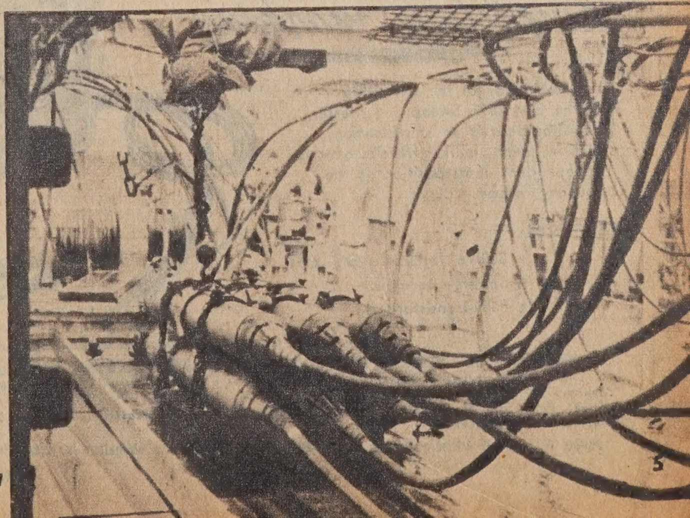
Because of the high frequencies used on land systems, the cable attenuation is high, necessitating repeaters every six miles for a 4 Mc system and every three miles for a 12 Mc system.

One of the main differences between land and sea cables is in the permissible repeater spacing, and therefore the bandwidth of the system. A repeater spacing of three or six miles would present many difficulties on a submarine system, namely:

1. On long cables the total number of components (about 300 per repeater) would be enormous and would increase the chances of failure. For example, a 2,000 mile cable with three-mile repeater spacing would have 200,000 components.

2. As submerged repeaters are fed in series with a direct current, the voltage dropped at each repeater being about 70 volts, the voltage which would need to

(Below): Submerged repeaters on the deck of the cable-laying ship Monarch during the laying of the telephone cable between the United Kingdom and Sweden. The repeaters are mounted on trolleys and taken aft to the laying gear.

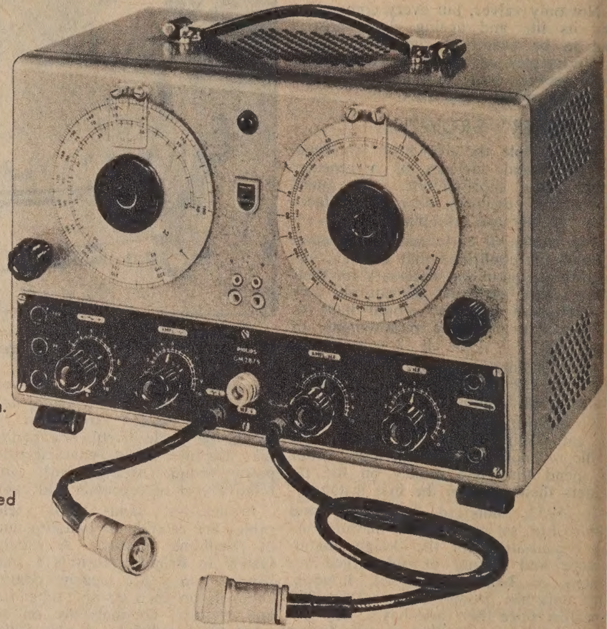


PHILIPS

Television Sweep and Marker Generator

TYPE GM 2875

for fast accurate alignment



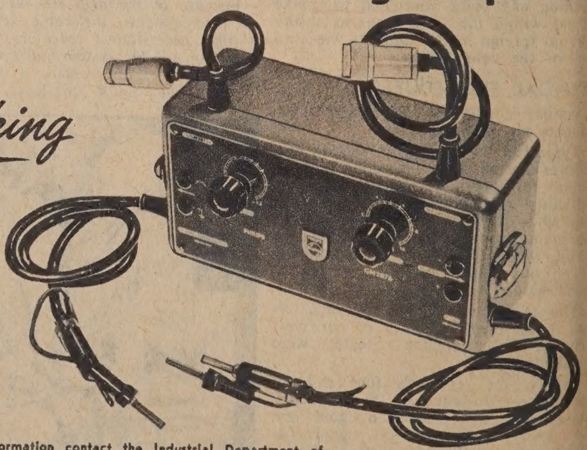
FEATURES

- Extremely high stability
- Frequency range from 5-220 Mc/s continuously variable.
- Internal 50 cycle frequency modulation.
- Sweep width of 0-25 Mc/s continuously variable.
- Built-in Crystal Oscillator.
- Marker Oscillator 25-55 Mc/s calibrated harmonics up to 220 Mc/s.

PHILIPS Transistorised Marker Mixing Amplifier

TYPE GM 2876

for constant amplitude marking



The combination of the GM 2876 with the GM 2875 Sweep and Marker Generator permits an amplification of the frequency marker the size of which is independent of its position on the frequency response curve.

FEATURES

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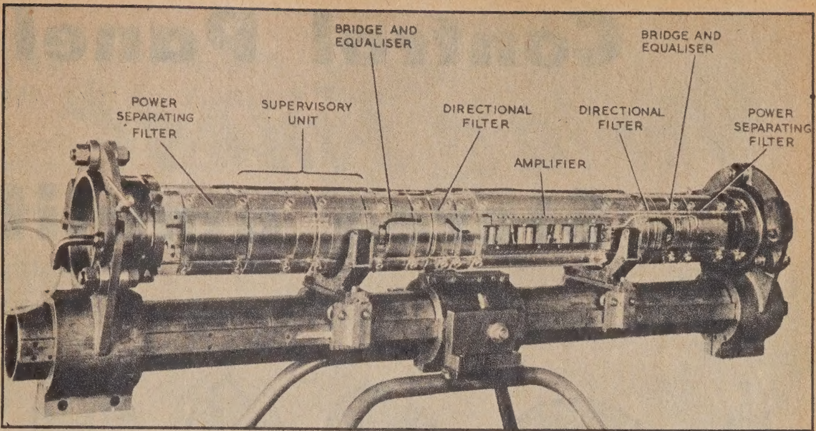
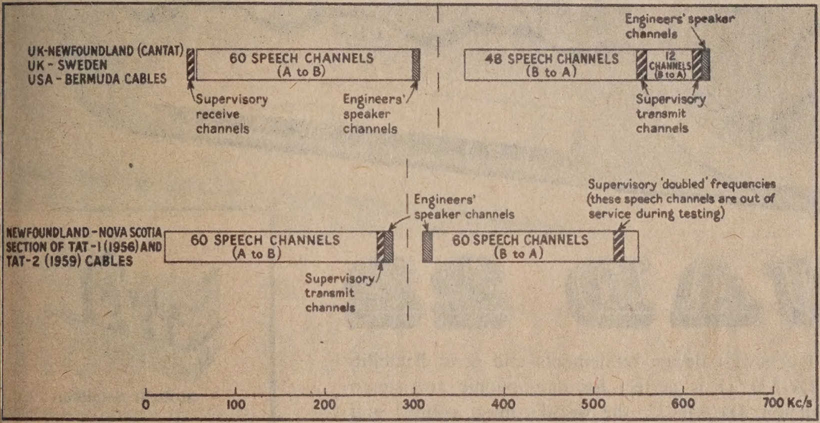
P2233/60

The picture on the right shows a repeater on its assembly and wiring rig. The individual units are contained in sealed metal cases. All major metal surfaces are gold-plated to prevent "whisker" growth through the years.


BRIDGE AND EQUALISER
POWER SEPARATING FILTER
SUPERVISORY UNIT
DIRECTIONAL FILTER
AMPLIFIER
DIRECTIONAL FILTER
BRIDGE AND EQUALISER
POWER SEPARATING FILTER

The diagram below shows the frequency spectrum handled by British two - way submerged repeaters on typical telephone cables. Note the provision for supervisory and testing channels.


UK-NEWFOUNDLAND (CANTAT)
UK - SWEDEN
USA - BERMUDA CABLES
60 SPEECH CHANNELS (A to B)
48 SPEECH CHANNELS (B to A)
12 CHANNELS (B to A)
Engineers' speaker channels
Supervisory receive channels
Engineers' speaker channels
Supervisory transmit channels
NEWFOUNDLAND - NOVA SCOTIA SECTION OF TAT-1 (1956) AND TAT-2 (1959) CABLES
60 SPEECH CHANNELS (A to B)
60 SPEECH CHANNELS (B to A)
Engineers' speaker channels
Supervisory 'doubled' frequencies (these speech channels are out of service during testing)
Supervisory transmit channels
0
100
200
300
400
500
600
700 Kc/s

be applied to the end of the cable would impose great strains on the cable and the end repeaters. For example, a 2,000-mile system with three-mile repeater spacing would require a power feeding voltage of nearly 50 kV.

3. The equipment required to supervise the system and locate faults would be very complicated and expensive.

4. A system with such a close repeater spacing might prove more expensive than two simpler systems with half the bandwidth.

5. The task of cable laying would be slow and difficult, especially since a large number of separate submerged equalisers would be required to take up the cumulative error left uncorrected by the fixed equalisers in the repeaters. These separate equalisers are adjusted on board the cableship during the lay.

On land coaxial cable telephone systems there is an established method of building up a frequency band out of individual telephone speech channels: the technique is known as "frequency multiplexing."

By a series of modulation processes using fixed carrier frequencies, large numbers of speech channels are lined up side-by-side in the frequency spectrum so that they can be transmitted without mutual interference. The separation at the receiving end is by highly selective filters followed by a demodulation process using the same carrier frequency as is used in the modulation process.

One of the basic frequency blocks used in carrier telephony is the Supergroup, which consists of 60 telephone channels at 4 kc intervals between 312 kc and 522 kc. For "two-wire" operation over a single submarine cable, this supergroup band undergoes a special modulation process at one terminal so that it occupies the spectrum from 20 kc to 260 kc.

Typical usage of the frequency spectrum is shown in the accompanying diagram. Note that the "High-Group" band is split to accommodate special supervisory tones sent from the terminal stations to test the cable and the repeaters.

A constant value direct current is fed along the centre conductor of the cable; this current passes through the valve heaters in series, the potential differences so produced being sufficient to be used as the valve anode and screen supply.

It is necessary to separate the carrier frequency signals from this direct current supply at each repeater. At each end of the repeater is a power separating filter which is, in effect, a DC blocking circuit. These filters must have very good insulating properties, since the voltage at which power is applied to the cable may be of the order of 8 to 10 kv.

The carrier signals thus separated from the power circuits are then routed through the repeater so that low - group and high-group bands are amplified together in a common amplifier but are equalised separately. Directional filters separate these bands at the input and output of the amplifier.

The amplifier unit consists of two three - stage amplifiers connected in parallel between common input and output transformers with a single feedback network. This arrangement permits one amplifier section to fail without appreciably affecting the overall gain, though the distortion is increased. This fact provides one method of testing the repeater from the shore terminal.

Duplication of some components is necessary so that the failure of a component in one half-amplifier does not adversely affect the other half.

In the repeaters manufactured prior to the U.K.-Sweden system, a supervisory doubler unit is used for checking the performance of the cable and repeaters from the shore terminal station.

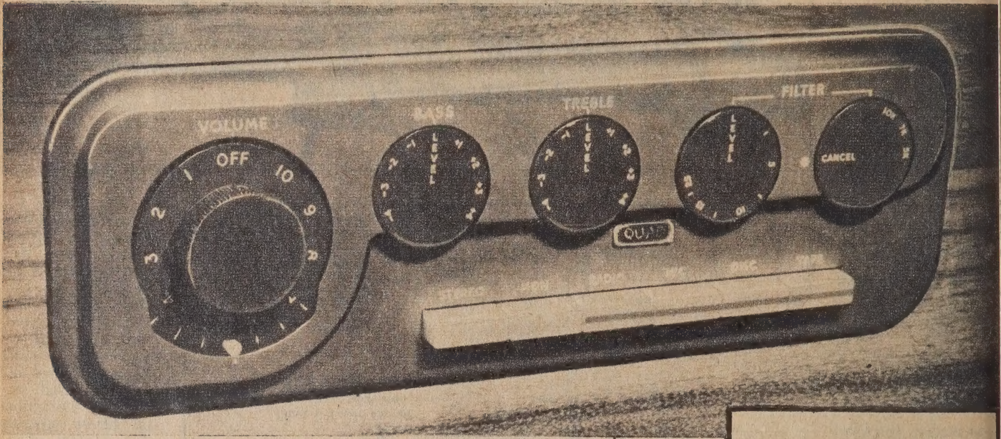
A supervisory tone in the low-group band is sent from the terminal station, the frequency chosen being peculiar to one repeater. This tone is doubled in frequency by the supervisory unit for which it was intended and, as the doubled frequency lies in the high-group band, it returns to the originating terminal.

As the original level and the received level are known, system performance can be evaluated up to and including the repeater in question.

The more modern repeaters contain more sophisticated supervisory equipment, since the latest cable systems contain a large number of repeaters and the earlier doubler circuit arrangement does not give sufficient testing channels. The new system also allows the source of a noise fault to be traced.

(Continued on Page 71)

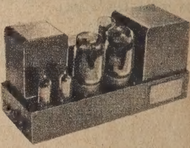
Control Panel of *World's Finest* Stereo amplifier



QUAD 22

Incorporating the newest design refinements and great flexibility of input, the **QUAD 22** is perfect for monophonic and stereophonic reproduction. **QUAD 22**, the world's finest control unit, has separate volume and balance (for stereo) controls, bass and treble controls and filter switch.

QUAD 22 operates from radio, microphone, disc, tape, single track and stereo. Matching is provided for any pick-up. Select input by depressing one, or a combination, of the four right-hand buttons, choose any of four playback characteristics from gramophone, then listen to *"the closest approach to the original sound"*. And, remember, this magnificent achievement is from a unit similar in size to the **QUAD 11** Control Unit. **PRICE: 64 GNS.**

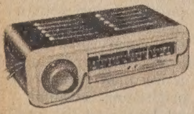


QUAD II Amplifier

Use one Quad II amplifier with your Quad 22 Control Unit for monaural, or two for the finest stereo.
The finest amplifier in the world, the Quad II produces 15 watts of undistorted power throughout the range 20-20,000 c/s.

PRICE: **60 gns.**

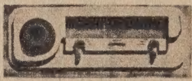
F.M. Tuner



Operates in conjunction with Quad 22 Control Unit and amplifier through your hi-fi speaker system. Tuner indicator shows a tuning error of one part in 10,000. Extremely low distortion and high-noise rejection.

PRICE: **56 gns.**

A.M. II Tuner



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Also operates through QUAD Amplifier and Hi-fi speaker system. Response is incredible when quality of its source is considered. Features: Radio Frequency Stage; Short Waves; Variable Selectivity; New Tuning Indicator.

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There are no servicemen in outer space!

The launching of a satellite is an anxious time for everyone—and that includes the engineers responsible for the electronic equipment which it carries. They well know that the usefulness of an otherwise perfect shot can be jeopardised by the failure of components worth only a few pence each.

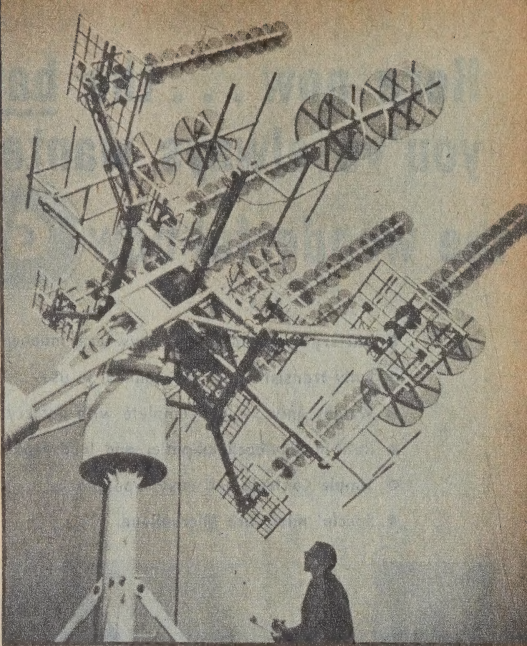
IN the grey dawn of November 23, 1960, a graceful white Thor Delta rocket lifted its 88-foot length thunderously from a concrete slab at Cape Canaveral, Florida, and arched purposefully out over the Atlantic.

Sealed within a streamlined fairing at the rocket's elongated nose was a drum-shape package of television cameras, TV tape recorders, infra-red sensors, control devices, and transmitters, ingeniously linked in a system known as Tiros II, the nation's second weather observation satellite.

Fourteen minutes later, 435 miles above the North Atlantic, the 280-pound Tiros was freed from its protective fairing and pushed into orbit at more than 16,800 miles an hour by a powerful third-stage rocket.

Within 100 minutes, the satellite passed over the east coast of the United States to complete its first trip around the world, transmitting to the ground televised pictures of cloud formations and measurements of heat levels in the earth's atmosphere — new data to aid weather scientists in drafting accurate forecasts of tomorrow's weather.

To the world at large, Tiros II, and its equally illustrious predecessor Tiros I leaped full-blown from the sands of Cape Canaveral to achieve resounding success in a matter of minutes, ably assisted by a fine rocket vehicle and a remarkable guidance system.



On this complicated aerial array at the RCA Astro-Electronics Division, Princeton, U.S.A., the first signals were picked up from a Tiros satellite. The radio gear was operative! Tiros, by the way, stands for Television Infra-Red Observation Satellite.

Radio Gear For Satellites

But a somewhat different view occurred each time to a large body of engineering specialists standing by in oddly-mingled confidence and hope, awaiting the achievement of orbit and the first successful returns from the Tiros satellites.

For these men, many of them engineers of R.C.A.'s Astro-Electronics Division in Princeton, New Jersey, the launchings were the climax of years spent in the development of the two satellites and their associated ground systems of communications, computing and control.

"Every big electronic system calls for a heavy dose of imagination, perspiration, and faith, along with good solid engineering," says Sidney Sternberg, Chief Engineer, R.C.A. Astro-Electronics Division.

CONCENTRATED FORM

"When the system is to be thrown out into space, you will find all of these ingredients present in concentrated form, along with a certain finality that has no counterpart in work on systems which will stay within our reach on the ground.

"With a space mission, you know that every piece in the system is going to encounter more stress and shock in a few minutes of launching than most ground systems face during years of operation.

"You know, too, that the space environment will expose your handiwork to greater extremes of temperature, vacuum and radiation than anything normally found on earth. Then, when you mount the package on the rocket and seal it up, you've had your very last look at it.

"If any one of the 20,000 or more parts gives out — even a conventional transistor — no serviceman is going to be around to slip in a replacement."

Viewed in this light, the Tiros satellites are classic examples of space technology at its present-day best. And, in classic fashion, their course from inception to completion was liberally strewn with headaches, frustrations, compromises, triumphs — and a degree of plain good luck.

In the chronology of the Space Age, the Tiros story has truly ancient beginnings. Says Barton Kreuzer, Division Vice President and General Manager of Astro-Electronics Division:

"We started off with a study of television satellite techniques for the Government back in 1951. That early work led eventually to contracts for development of hardware by the R.C.A. engineering groups. Through much of the 1950s, matters of jurisdiction and objectives in the nation's space program remained rather fluid.

"It was mid-1958 before a get-together among Government, university, and R.C.A. people finally focused the program on a meteorological satellite and produced the specific mission requirements that made it possible to go ahead with the Tiros system."

In the meantime, the R.C.A. engineering staff had gained priceless experience in developing techniques for meeting the new requirements of space flight, including construction of a prototype 20-pound television satellite.

By early 1958, advances in missile technology had made it possible to proceed with development of a larger and heavier satellite — the one which ultimately took form as Tiros. Translating a set of mission requirements into an operating satellite system is unquestionably near the top of the list of major technical challenges of our time.

By Kenyon Kilbon

In the case of Tiros, this is how it appeared to Edwin A. Goldberg, who shared with Vernon D. Landon the engineering management of the Tiros project for R.C.A. through the successful launching of the initial model.

"We had a nice clear prescription to fill — a system that would look at cloud formations, photograph them, store the pictures, and transmit them to the ground on command. We had a lot of good ideas for doing the job. But it's still a little frightening to contemplate in one sitting all of the

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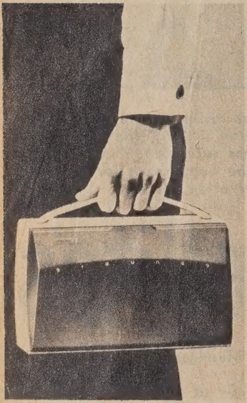

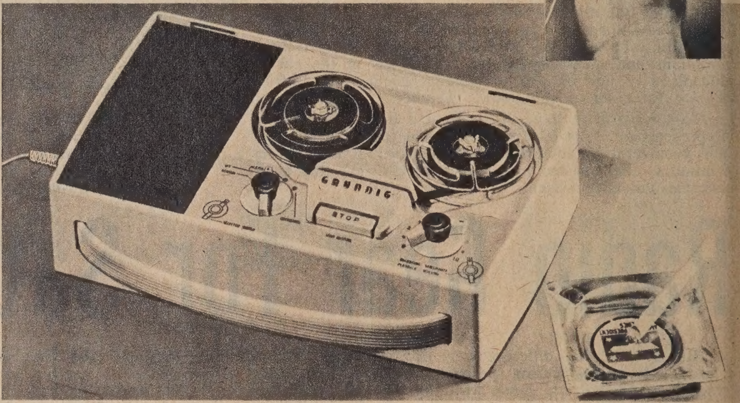

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detailed technical and operating requirements that had to be met.

"To consider just one aspect, we had to work within weight and size limits set by the launching rocket, which permitted us a package of 270 pounds on the first shot.

"Into this total we had to design two TV systems, including cameras, tape recorders and transmitters; controls programming their operation; tracking and telemetry equipment; power supplies, and dynamic control devices for the desired spin and attitude.

"There's nothing basically strange to us about any of these techniques—but getting them all into a 270-pound package is perhaps a little like the initial job of tailoring a nuclear reactor to fit into the Nautilus."

Ingenious engineering designed and produced the components to fit the package—items such as rugged little television cameras weighing only 4½ pounds, for taking still pictures as Tiros circled the earth, and 12½-pound video tape recorders for storing up to 32 pictures from each camera during each orbit.

COMMUNICATION EQUIPMENT

At the same time, other groups of Astro-Electronics Division engineers worked out the complex ground station equipment needed to communicate with the satellite.

The knottiest problem arose, however, in blending the components in a system capable of reliable operation in the brutal environment of space. Odd things happens in the space environment. Ordinary lubricants evaporate, for example, in the high vacuum hundreds of miles above the atmosphere.

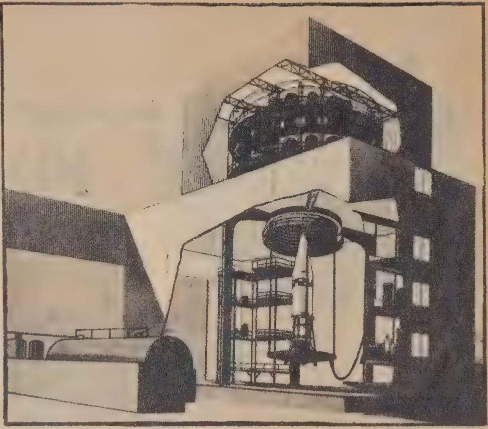
Objects become weightless, meaning that a slight impetus of the wrong kind will cause them to tumble or spin almost indefinitely unless special means are devised to control their motion.

The absence of any atmosphere to level off extremes of temperature results in great heat on surfaces facing the sun, and extreme cold on those in the shade.

"It's not what you'd call a paradise for machines or men," says Abraham Schnapf, who was R.C.A.'s Project Manager for Tiros II. "And not only that—but the equipment can't even get out there without taking almost as much of a beating as if it had been shot from a cannon."

For this reason, much of the critical development work called for special test equipment and methods to simulate the shock and stress of launching, and the natural forces that would work on the complete satellite system in outer space.

Cameras, tape recorders, transmitters, electronic control "clocks," infa-red sensors and other items were buffeted on shock and vibration machines, baked and frozen in vacuum chambers, and rechecked again and again to see whether their operation had been affected.



Scheduled for completion this year, Lockheed's high vacuum orbital simulator (HIVOS) is designed to test satellites and their equipment under conditions which will be as near as possible to those which obtain in outer space. From searing heat, the temperature will be variable down to near absolute zero.

Equipment bought from subcontractors and the infrared system developed for Tiros II by the National Aeronautics and Space Administration went through the same rigorous testing.

Weak spots were brought to light. The effect of high vacuum upon lubricants was observed, and the decision was made to maintain a degree of atmospheric pressure for the moving elements in the TV tape recorders and electronic clocks by enclosing them in pressurised cases.

Storage batteries, tightly sealed beyond the requirements of any earthbound application, were found to need redesigning to withstand the vacuum, temperature extremes, and radiation in space.

Engineers laboured over the dynamic problems of keeping Tiros stabilised in orbit. During the final stages of its journey into orbit, the satellite and its third-stage rocket would be spinning at about 120 revolutions per minute to keep them on an even keel, and there was also a chance that Tiros might acquire a side-to-side wobble during the separation from the third stage.

SLIDING WEIGHTS

With the help of slide rules, computers, and special test rigs, the R.C.A. engineers calculated the various effects. They designed a system of sliding weights inside the satellite to absorb the wobble, and "yo-yo" weights at the end of long cables to slow the spin rate to the 10-to-12 r.p.m. needed to maintain stability without hindering picture-taking.

"You have to be careful about sticking your head into rooms around here," Goldberg recalls. "There were some spots where you stood a good chance of being flailed by flying weights. You can still see some dents in the walls."

The final steps in engineering Tiros called for the same kind of testing for the complete satellite with all of its electronic contents.

In a large vacuum tank at the Astro-Electronic Space Centre, the whole package was carefully manoeuvred into place and operated for long periods in a high vacuum, exposed at the same time to extremes of heat and cold.

"We couldn't actually trot it up to 450 miles in space to see how it worked, but the vacuum chamber gave us a pretty good approximation," says Sternberg. "Considering that the payload by this time added up to nearly 20,000 separate pieces that had to work smoothly together, we found

(Continued on page 60)

Inside this strange-looking spherical cage, a Tiros II satellite is subjected to magnetic fields closely resembling those to which it was ultimately exposed during launching and orbit.

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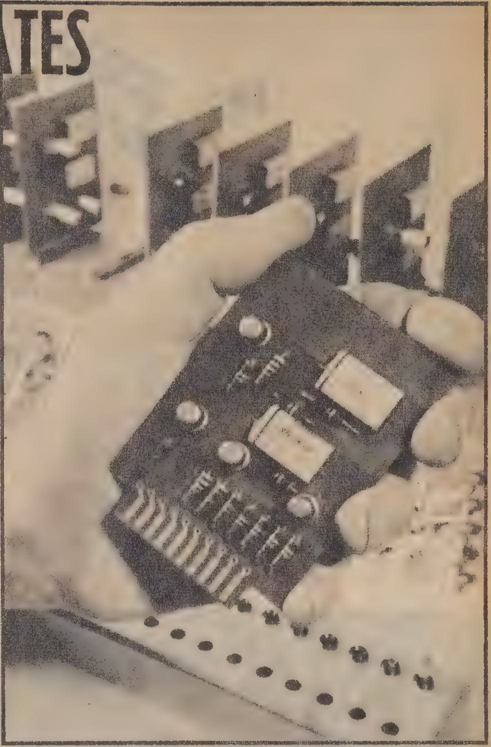
SIMPLE CIRCUIT IMITATES A LIVING NERVE CELL

Scientists at Bell Telephone Laboratories have put together on a three-inch by four-inch, printed-circuit card a simple electronic device that outwardly imitates the living nerve cell, nature's tiny building-block of the nervous system.



USING a number of the inexpensive cells, research men have recently begun attempts to follow nature further. Cell by cell, they are building electronic systems that imitate some of the simple workings of nerve networks in the eye and ear—the human end of the communications chain.

So little is known about the operations of the nerves that much of this work is experimental and intuitive. Yet the electronic cells can provide a new avenue of approach for scientists investigating the functions of nerve networks.

"The similarities to biological nerves are at best vague and approximate," explains Leon D. Harmon, who initiated this project. "But by working the problem back and forth between the two disciplines—electronics and physiology—we may learn more about how the nervous system operates."

The electronic cell delivers a series of electrical pulses when stimulated, just as a living nerve cell does. It also fails to respond under conditions where a biological cell would not respond, and can show "fatigue" like a living nerve cell: that is, slow down under prolonged stimulus.

CELLS ARE INEXPENSIVE

Because the four-transistor nerve cell, designed by Robert M. Wolfe, is inexpensive, many can be used to build networks. Afterwards, the laboratory men can do what nature does not: disassemble the networks and use the nerve-cell building blocks again in new combinations.

The nerve cells have been assembled with photo-cells to imitate the simple functions of nerves in the retina of the eye: "on" receptors, or sense organs, that pulse with increasing light; "off" receptors that pulse on decreasing light; and "during" receptors that pulse on steady light.

The cells have also been made to "see" a rapidly flickering light as a steady one, just as the eye sees a series of flashes without flicker, as in motion pictures and television.

Experiments similar to these have been started wth ear-models by Willem A. Van Bergjeik.

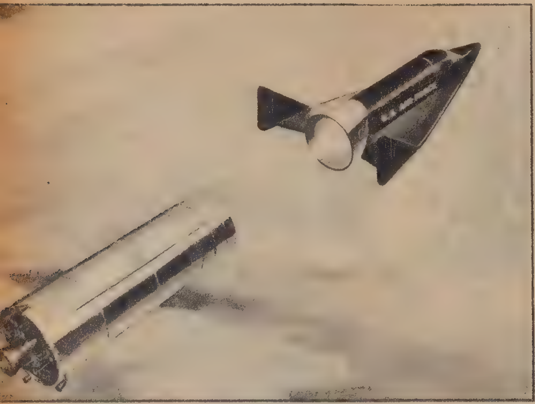
So little is known about the nervous system that even the key to the code that nerves send to the brain remains secret from neurological cryptographers. So does most of the brain's deciphering equipment itself. Yet scientists can describe the intricate routes followed by nerves through the human body—an electric network that outwardly resembles the telephone system.

Bell Labs' basic research in visual and acoustic communications includes the study of human interpretation of sound and picture, another part of the "human-equipment" link between an actual event and the personal appreciation of it. Other projects range from the study of methods of coding speech and pictures to the construction of "intelligent" machines, such as those that can recognise patterns.

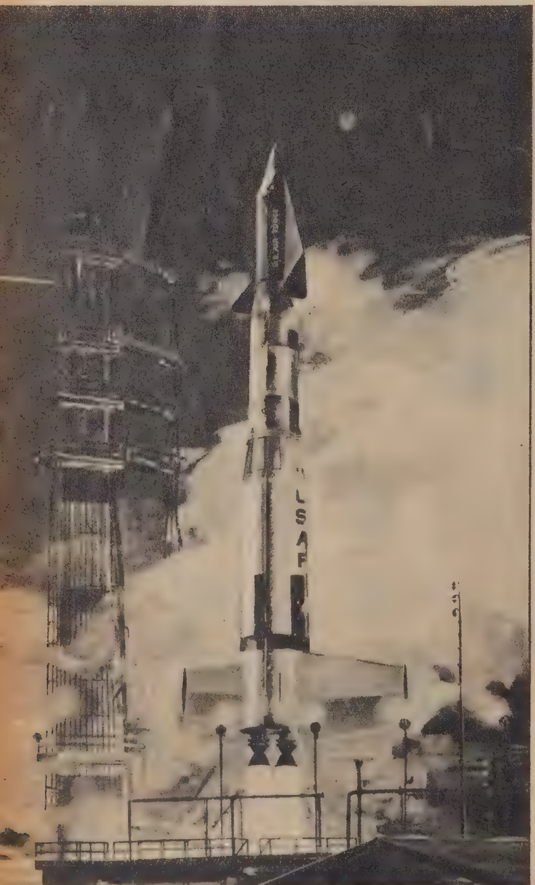
Knowledge derived from such basic research may lead, as it has in the past, to better and more economical communications.

Picture at the top shows a simple transistor circuit development at Bell Telephone Laboratories to imitate the action of a living nerve cell. Elements are mounted on a printed-circuit card for convenience in handling. Lab. research men assemble many such cells into experimental networks—one appears in the background—that imitate some function of nerve in the eye or ear, the "human equipment" links of communication.

A network of electronic nerve cells is assembled by L. D. Harmon of Bell Telephone Laboratories, who initiated a project of simulating the functions of nerve cells with a simple transistorised circuit. This array of cells imitates some functions of nerves in the eye.



The rocket plane X-15, recently in the news with high speed probes to the edge of space, is a forerunner to the Dyna Soar space glider, shown as it is expected to appear as its booster falls away. It is expected to glow white hot on re-entry.



Another artist's impression of the Dyna Soar about to be launched by a modified Titan Intercontinental Missile. It is almost certain that one of the protective coatings now being developed will be used to protect the glider during the critical re-entry period.

UNIQUE COATING TO BEAT HEAT BARRIER

One of the toughest problems in space engineering is presented by the heat barrier; extremely high temperatures generated by air friction when a space vehicle re-enters the earth's atmosphere at speeds around 18,000 miles an hour.

FOR nearly two years Boeing research men have been working to develop a coating to protect certain metals against deterioration from heat and air friction. A coating recently devised has the desired qualities.

The research project began with the need for a method to protect some of the most promising structural materials for re-entry space craft: alloys of columbian and molybdenum. These alloys retain their strength at high temperatures, are available in sheet form and can be fabricated into complex structures.

On the debit side, columbian alloys when heated in flowing air form yellow to white oxides which melt at approximately 2,650 degrees F. At this temperature the exposed base metal becomes incandescent and rapidly deteriorates.

Molybdenum alloys give off white smoke and form black scales when heated under similar conditions, and their rate of metal loss is even greater than that of columbian alloys.

The research group made an appraisal of existing coatings which might prevent the formation of oxides on the alloys, which in turn would prevent loss of metal and subsequent structure failure. Tests showed that available coatings were inadequate for the purpose.

COATING LIMITATIONS

Reasons for these inadequacies varied in different cases. Some of the reasons were: application of the coating brought about undesired alteration of base-metal properties; the coating would not satisfactorily cover recessed areas, blind holes and edges, and the coating would not withstand multiple tests simulating the end-use environment.

Requirements for the coating system were stringent. The coated alloy had to be oxidation resistant under stress, vacuum and vibration; to be inspectable; to retain its base metal properties; to be reliable; to transfer heat rapidly at use temperatures; to have easily reproduced physical and chemical characteristics; to be repairable if damaged and to be chemically compatible with adjoining materials. The coating had to be applicable to complex joined parts.

Continuing their search for a satisfactory skin you would not love to touch — at least, not when it glowed white hot during re-entry — the engineers finally came up with a coating and process of application that shows great promise of doing the job.

Described as the Disil process, the coating is being used at a Boeing manufacturing plant in Seattle on test parts. The process involves the application of silicon and other materials to the surface of molybdenum.

The part to be coated is packed in a retort containing blended powdered materials. The retort is sealed and heated in a furnace to temperatures between 1,700 and 2,000 degrees F.

Tests have shown that the Disil coating on molybdenum is black, hard, has good erosion resistance, is not porous, has good shock resistance, has good self-healing properties above 2,500 degrees F., remains stable to more than 3,200 degrees F. and weighs only .01 pound per square foot.

Negligible weight changes occur when the coated metal is heated to 2,700 degrees F. in air. Exposures in oxidising gas streams for more than one hour at 3,000 degrees F. have not detrimentally affected the coating. Specimens heated to 2,700 degrees F. and loaded to 8,000 pounds per square inch have demonstrated the coating's ability to protect the metal while under stress and heat in an oxidising atmosphere.

A Disil coating on a columbian alloy has been tested with good results. The alloy was adequately protected for 1 hour and 45 minutes at 3,000 degrees F. and for 15 minutes at approximately 3,400 degrees F.

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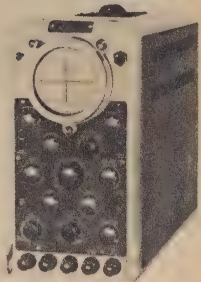
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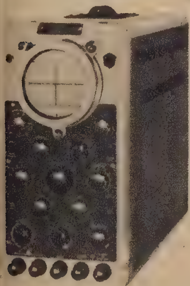
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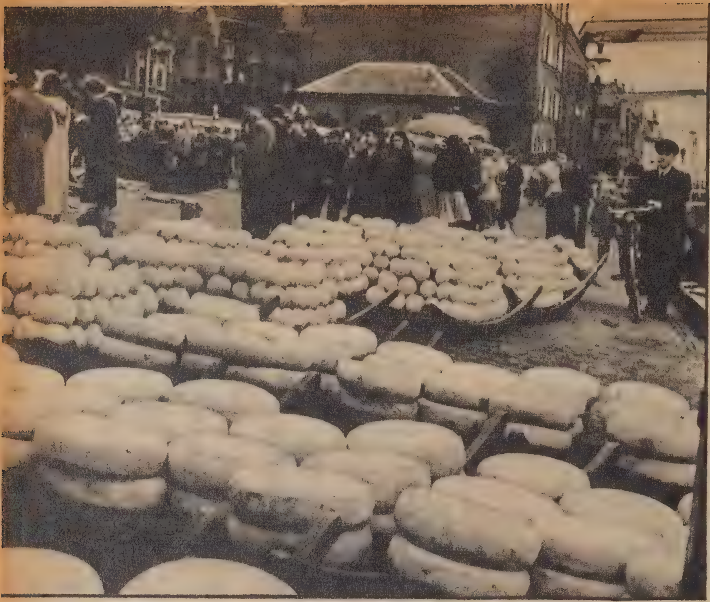


The cheese market, conducted every Friday at Alkmaar in Northern Holland. The production of cheese depends on the activities of certain very helpful bacteria, as explained by Calvin Walters.

Bacteria—Good, Bad & Indifferent

Don't shudder at the mention of bacteria, germs, microbes, etc. Only about one per cent of all microbes are producers of disease in man and animal and the activities of these are being gradually controlled. The rest help to make life worth living.

THIS small percentage of microbes gets all the others a bad name which is quite undeserved for, without the good "wogs," life would just about be impossible.

This feature of good and bad is not confined, of course, to the world of microbes. There are good people and bad people. Within this general category there are groups of people who carry out certain functions necessary for the maintenance of our society.

GOODIES AND BADIES

Thus there are good politicians and crook ones. Good lawyers and crook ones. Good "bookies" and crook ones, doctors, builders, estate agents, salesmen and all the rest.

It is the "crook" ones who get the others a bad name, because human beings are prone to forget the good and remember the bad.

It is the same about microbes. Just because one per cent of the microbes are "crookies," we forget that the other 99 per cent do a good job of making our life on earth not only possible, but somewhat easier.

There are microbes, for instance, which work in the soil to make nitrogen available for plants. Without this there would be no plants and therefore no animals. There would be nothing for anyone to eat.

Then there are others which work in milk to produce cheese and butter. Still others give us vinegar, bread, pickles, sauerkraut, and the like.

Large numbers of products are partly the result of microbic "goodies," including leather, tobacco, linen, rubber, adhesives, to say nothing of beer, wine and other fermented beverages.

Imagine what the earth would be like without the microbes which cause decay and decomposition. The whole earth would be strewn with layers of dead trees, leaves and the bodies of animals and humans. It would be impossible to live on the earth, even if we could find room to move about.

by Calvin Walters

Whilst the bacteria, as we shall n call them, are situated at the ve bottom of the scale of living thin they are both interesting and stran They are the smallest, but they perfo some very complex operations to ca out their functions.

Bacteria possess neither roots, ste nor colouring matter, as do plants. Th have no arms, legs or bodies, but a merely single cells possessing all t internal functions enabling them to e multiply and grow.

Bacteria are so small that the u of measurement for them is the micr which is about one twenty-f thousandth of an inch.

To give some idea of the size of average microbe, let us consider t Bacillus Typhosis which causes typh fever. This is about one twel thousandth of an inch in length a one twenty-five thousandth of an in in diameter. If about thirty thousa typhoid germs were laid end to e they would take up the length of ordinary match.

About fifteen millions of millions typhoid germs would weigh only o ounce.

THREE GROUPS

Microbes or bacteria can be classifi into three basic groups. These are t cocci, which are spherical in shape, t bacilli, shaped like small rods and spiri in the form of spirals.

Within these classifications there a certain modifications according to t manner in which the bacteria live a their method of locomotion.

For instance, some like to live alo like the cocci. Others like to live w a cobber. These are the diplococci. So live in groups of four. These are call tetrads. Then there are the ones whi link up like a chain, such as the strept cocci and others which hang togeth like a bunch of grapes, the staphylococ Those which live in groups of eight a called the sarcino.

Bacteria move by having thin, ha like appendages which they move swimming fashion. Here again, t method is quite varied and the numb of appendages varies with the speci

VARIETIES

There are bacteria which have the appendages all along the length. Othe have them at one end only, others both ends. Whilst these appendages a very delicate, they may be two or thr times the length of the body. Ho delicate they are may be seen when is estimated that they are about o two hundred and fifty thousandth of inch thick.

Locomotion is achieved by rhythm contractions of these treads which prop the bacteria through the medium li an oar of a boat. The speed of motio is relatively great, about 0.0012 of inch per second. If a man moved th fast in proportion to his size, he wou be travelling at sixty miles per hou

Some bacteria are furnished with

g-like object called a spore. Most have ly one spore which may be in the ntre or at either end.

These spores are a very interesting henomenon, being provided to allow e bacteria to survive adverse conditions.

Fortunately for us, none of the acteria which cause epidemics such as phoid, pneumonia, cholera and so on e provided with the spores. This makes much easier to kill them off.

In a spore-producing germ adverse nditions such as lack of moisture, unvourable heat or cold causes a change occur in the body of the cell. This ange can be clearly seen under the icroscope. The substance inside the ll becomes cloudy and a shining mass gins to form which is soon covered th a comparatively dense membrane. his mass is the spore and may be of size greater than the diameter of the ll.

HIBERNATION

The spore serves the purpose of oring enough of the vital substance the cell to allow it to go into a nd of hibernation, thus maintaining le at a very low level of vitality. The ick membrane in which the spore is closed and the removal of part of the oisture from the cell substance within e spore enable it to increase its resisnce to adverse conditions such as emical poisons, heat and drying in rticular, conditions which, without the ore, would be fatal to the bacteria.

Many instances have been cited of cteria having been revived from spores hich have been kept in a dry conion for half a century or more.

This characteristic of spore producing a vital one for the preservation of eful bacteria in the soil. Without it e bacteria would not survive the tremes of drought and heat, so that e soil would take a long time to generate after such conditions came an end.

Before proceeding further some menn should be made of some familiar ing things which live just above the sition on the scale of life occupied the bacteria. These are the yeasts d molds.

Yeast is familiar to us in the manucture of bread and fermented beveres. They carry out their functions by acking sugar and converting it into ohol and carbon dioxide. In the case bread, the carbon dioxide in the form of gas causes the aeration of the dough which rises with the gas and bakes into a light spongy bread full of bubble holes caused by the gas. It so happens that the alcohol is evaporated away by the heat, otherwise we would all be intoxicated after breakfast.

If you've ever suffered from Herpes, you can blame this spectacular looking virus. Fortunately, this is only a model, five million times larger than the real thing.

In the case of beverages the alcohol is retained by the fluid and the carbon dioxide is saturated into the solution, thus causing the gas and sparkle.

YEASTS LARGER

Yeasts are somewhat different from ordinary germs in that they are about ten times larger. The yeasts multiply by budding while they grow or by forming spores under unfavourable conditions, whilst the bacteria multiply by division. The spores of yeast are very prevalent in the air and soil and are often the cause of unwanted fermentation in fruit juices or any sugary substance exposed to the air.

Moulds consist of a number of cells arranged in the form of threads containing spores which are often coloured. They are familiar to us as the furry growth on jams and preserves. Like yeast, the spores are prevalent in the air. Moulds are responsible for the characteristics of certain cheeses such as Stilton, Gorgonzola and others.

Most will know that the lifesaving drug penicillin was formerly extracted from a mould of the same name. Here, indeed, is a prime example of the usefulness of a growth which is commonly looked upon as a nuisance.

The study of bacteria came about because of the discovery that they were the cause of certain diseases. It was inevitable that these disease-producing germs were the ones to which research was almost exclusively applied. During such research many facts were discovered regarding the behaviour of bacteria, which have been applied to guard us against the inroads of harmful varieties.

For instance the fact that bacteria must have moisture to enable them to be active is the basis of preservation of food by salting, as in corned meat, suspending in strong sugar solutions or drying.

There does not seem to be a great connection between depriving a germ of moisture by putting it into a salt solution containing a lot of moisture. How can this be?

A prevalent fallacy is that salt acts as a disinfectant and kills the germs. This is not true.

THE REAL STORY

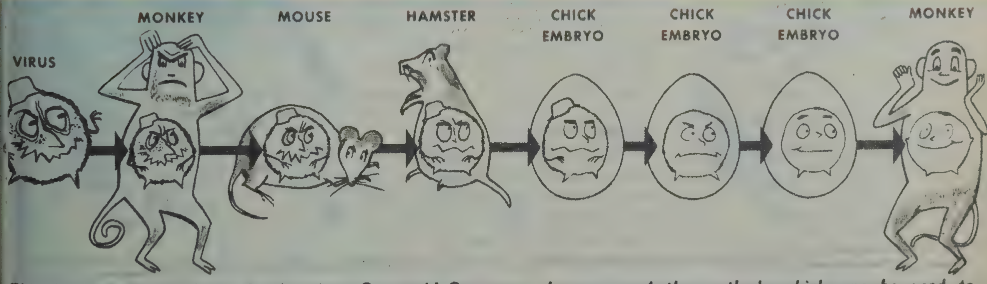
Let's begin at the beginning. Every living man, animal or germ has about 85 per cent of water in its make-up. This water is held in the cells by means of complex organic compounds which form, with the water, a jelly-like substance in the cell.

This jelly-like substance is held within the cell by means of an outer membrane which is semi-permeable. This means that it will allow the water to flow in and out of the cell, but will not allow the passage of the jelly-like cell substance.

Now it is well known to the cook that salt takes up moisture rather rapidly. See how it becomes damp on a humid or damp day. See how it exasperates father when he tries to shake damp salt on to his breakfast egg from the salt shaker.

If a germ cell is immersed in a strong salt solution the affinity of salt for water immediately starts a flow of water from the cell **outwards** through the membrane into the salt solution. At the same time, salt goes into the cell to equalise the pressure.

The net result is that the germ cell



This diagram, prepared for the American Cyanamid Company, shows one of the methods which can be used to weaken viruses, in this case the virus of polio. The virulent virus found in nature is forced to grow in "hosts" which are not their natural prey. In adapting itself to live successfully in monkeys, mice, hamsters and chick embroyos, the character of the virus is changed. It becomes "tame" so that, when it is returned as on oral vaccine to monkeys or to man, following attenuation, it can no longer cause polio. Yet it can still set off the mechanism in man which produces immunity.

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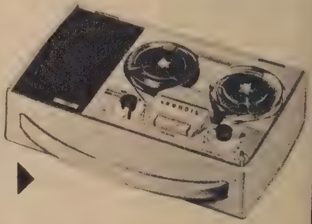
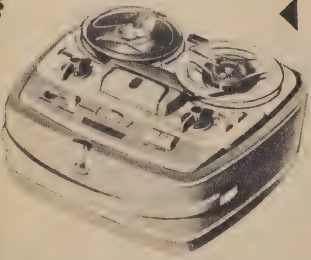
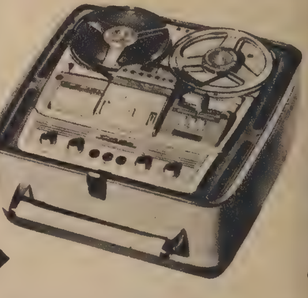


MAINS OPERATED



GRUNDIG TK28. A 4-track machine with 2 speeds for high-quality recording and facility for stereo playback (standard playback time, 12 hours). Complete push-button control . . . provision for micro/phono attachment. Weighs 25 lbs. in case. **169 gns.**

GRUNDIG TK64. A truly magnificent versatile recorder. 4-track with simultaneous stereophonic record and playback. Push-button control. Plays 8 hours mono, 4 hours stereo. **299 gns.**



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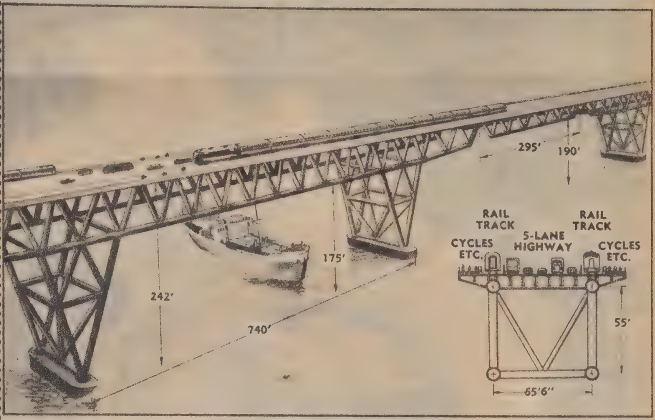
PROPOSAL FOR CHANNEL BRIDGE



CURRENT moves to get started on a tunnel beneath the English Channel (see our last issue) have sparked off counter proposals for a channel bridge. Several very highly placed British engineers and several large engineering firms are backing the bridge as a better solution to the whole problem than a tunnel.

It would be expensive, costing somewhere in the region of £200 million but it would have many advantages to offer, as indicated by the drawing above, which is based on current suggestions.

The 21-mile bridge would have twin railway tracks and a 5-lane 49ft wide motor highway, with special 13ft tracks for cyclists and motor cyclists. With no ventilation problem, all motor traffic could be self-powered and the flow continuous.

Height of the proposed bridge would be 242 feet and the span between pier centres 740 feet, except for two wider navigation openings. At high water, there would be a minimum "headroom" of 170 feet. Over 40 of the 142 piers would be at a depth of 130 to 165 feet.

ecomes depleted of water to the point vhere the germ loses its activity or dies, ot because salt is a disinfectant but ecause it takes away the water from the ell.

Thus the mechanism of corning or ickling becomes clear. No bacterial rowth can take place in such a salty nvironment.

It was over one hundred years ago that French chappie named Appert discovred that when fruits were immersed in trong sugar solutions they became preserved" against the inroads of oulds and other processes of decay.

Appert may have noticed that honey, hich is a concentrated sugar solution, ept indefinitely, never showing signs of ould or ferment.

NATURAL PRESERVES

The bees were the first to use concenrated sugar for food preservation but ver since Appert made his contribution, e immersion of fruit in concentrated ugar solution has been the standard rocess amongst canners.

The mechanics of sugar solutions are e same as for salt solutions. Sugar, owever is even more effective than salt withdrawing water. It is fortunate ineed that two such opposites as sugar nd salt display the same properties in is regard, for it enables us to use the ethod most suitable for the product. eat soaked in sugar or fruit in salt ould be most unpalatable products.

The drying of food has, of course, the ame effect on microbes as the withrawal of water by any other means.

Thus the drying of meat, fish and egetables is an ideal way in which to reserve food in circumstances where ickling in salt or sugar is not convenint.

Whilst there are some bacteria which an live in above normal livable temperatures such as those which live, for me reason not explained, in hot rings at about 140 degrees Fah. most ill not survive above the temperature f its environment.

Soil bacteria flourish best at about 60 70 degrees Fah. Disease germs of the uman being flourish at 98.5 degrees, ose of birds at about 102 degrees. To ill off most of these germs it is only ecessary to raise the temperature a few grees above that of the environment. Thus boiling is a very effective way of erilisation, although temperatures elow this are effective for most disease rms.

ASTEURISATION

It is upon this fact that the process own as Pasteurization of milk is founed named after the famous Pasteur who scovered it.

The milk is heated to 140 degrees ah. and kept at this temperature for venty minutes. It is then cooled rapidly 40 degrees and, provided it is mainined at somewhere near this temperare, afterward, it will keep for many ays.

This effect of low temperatures on cteria is quite the opposite to the fects of heat. Whilst moderate degrees heat are fatal to most disease-producg germs, they may be subjected to surisingly low temperatures without fatal fects.

In experiments, bacteria have been mersed in liquid air which has temperature of 300 degrees below zero Fah. When thawed out very carefully they have been found to have suffered no ill effects and will flourish normally.

However the substance in which the bacteria are frozen has some bearing on their survival or otherwise. For instance if bacteria are frozen in water they will almost certainly be killed. This is due to the fact that the ice crystals which surround them crush the life out of them.

In addition to this, the water in their cells also freezes and, as ice expands, the walls of the cell are therefore ruptured. Alternate freezing and thawing is a good way to sterilize water.

With the exception of germs in frozen water, cold has merely a retarding effect on the activities of most bacteria. This is the principle of the household refrigerator. So long as bacteria are held at a temperature below that of their normal environment they will tend to reduce their activities. The lower the temperature which is practical the better.

FRIENDLY MICROBE

Among the many friendly microbes we can now name two which have an interesting action on cabbage in the manufacture of Sauerkraut.

Shredded cabbage is treated with 2½ per cent of salt to extract the sugary juice. The cabbage is tightly packed in covered vats.

Here a microbe known as Leuconostoc mesenterioides takes over and ferments the juice until the content of lactic acid is about .7 per cent. Here old Leuconostoc makes way for two kinds of lactic acid bacilli. One of these carries the fermentation to a certain point and the other finishes it off. During the fermentation process changes take place in the proteins of the cabbage, with the formation of lactic, succinic, and acetic acid, together with ethyl alcohol and mannitol. It is to these that the product owes its flavour.

LACTIC ACID

The lactic acid bacillus seems to be involved in a lot of processes beneficial to man and is particularly evidenced in the making of ensilage for livestock.

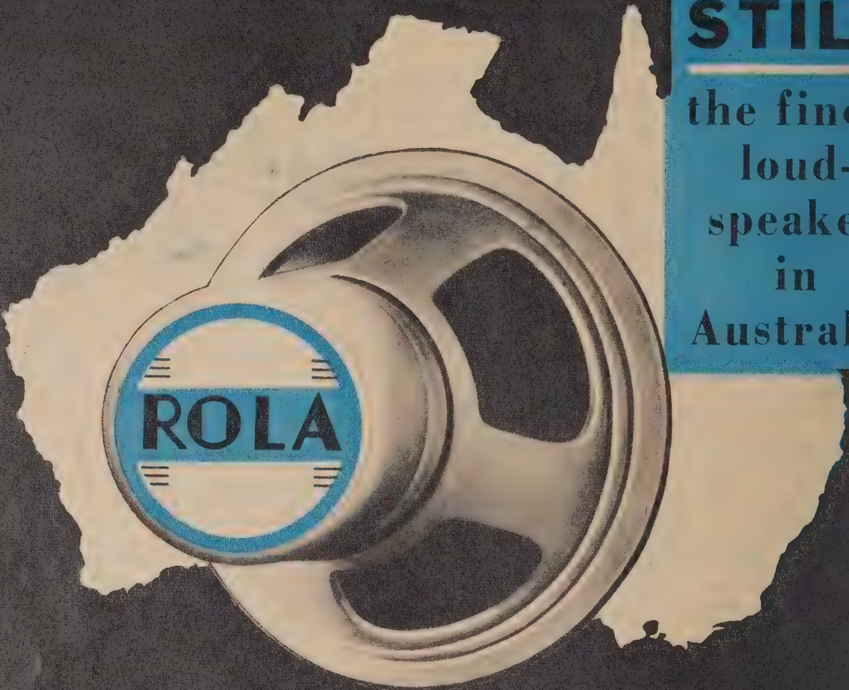
In this process farm products, particularly lucerne, sorghum and other succulent plants, are chopped up and placed in those huge concrete containers one sees sticking up to the sky on many country farms. Fermentation takes place mainly by the Lactobacillus and in about a month's time the process is complete. The plants are preserved by the formation of lactic acid, alcohols and other bacterial products and will keep for years. The appearance, flavour and food value is greatly enhanced and cattle relish the food.

In the making of chocolate and cocoa the flavour is greatly enhanced by a fermentation process where the beans are

(Continued on Page 127)

STILL

the finest loudspeaker in Australia



Model 12UX Hi-Fi

Laboratory measurements and listening tests continue to prove the Model 12UX the outstanding loudspeaker in the current Rola range — still the finest loudspeaker in the Commonwealth. This statement holds true irrespective of price, for the 12UX will outperform loudspeakers costing nearly twice as much. Any loudspeaker intended for high fidelity applications must possess good Transient Response, a smooth Frequency Response, adequate Power Handling Capacity and low Intermodulation Distortion. The Rola Model 12UX has all these features — and in good measure.

Its large magnetic unit employs the latest high energy magnet material and has been designed to provide the utmost efficiency. This in turn results in first class Transient Response, an essential feature if "clean", crisp reproduction is to be obtained.

The Frequency Response of Model 12UX meets the most stringent requirements of the most critical listener and is within ± 6db. between 40 cycles per second and 14 kilocycles per second. Its triple cone construction provides smooth mechanical cross-over and avoids the phase displacements and consequent distortions encountered in multiple loudspeaker combinations.

Finally, its Peak Power Rating of 30 watts at an extremely low level of Intermodulation Distortion means that under normal operating levels this distortion will be too low to be detected by the most critical ear. These are the reasons why the Rola Model 12UX is still the finest loudspeaker in Australia.

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Technical Review

MODERN ELECTRONICS HELP RAILWAYS CUT COSTS

Since the end of World War II, U.S. railroads have spent more than 15 billion dollars in capital improvements trying to beat rising operative costs. Electronics features prominently in these cost-cutting plans.

ALSO, several railroads plan to use computers to regulate train operations, route freight cars, and process cars through their yards. Many are using closed-circuit television to replace human observers. They are also looking to gamma ray detectors, infrared devices and other electronic developments to cut costs.

There is one particular place where electronics is saving railroad money. It's New York Central's "Big Four" classification yard in Avon, some seven miles from Indianapolis. The yard began electronic operations late last year and now has four automated yards. Several other roads have them, too.

MODERN FREIGHT YARD

A classification yard sorts freight cars by destination and assembles them on outbound tracks.

It cost 11 million dollars to revamp the 490-acre installation. Railroad officials say they expect to recoup the investment in three years.

Nerve centre of the Big-Four yard is an analog computer built for the Central by General Railways Signal Company, Rochester, N.Y. Given information on incoming freight cars, this computer controls routing from the moment input information is received until the car is coupled to a train.

Here's how it works. A tower operator observes an entering car and assigns its destination by pushing a button indicating a classification track. The car rolls down a hill leading to the makeup tracks, controlled solely by the computer.

As the car rolls, its length, weight class, rolling characteristics, and speed are fed to the computer. Length is found by measuring the time during which the car intersects the beam of a photocell, weight is found by automatic detectors n the tracks. A series of treadles along he tracks checks the car's location, helps he computer determine rollability.

The computer applies a current to the racks, derives a resistance depending upon the distance between a moving car and the last standing car in the train being made up. The computer regulates he speed of the moving freight car by activating retarders along some 200ft of the route. The retarders clamp in on he car wheels.

Speed is determined by a radar operating at 10,525 Mc using a fixed-tuned klystron. Putting out about 70 milliwatts, the radar has a range of some 200ft. Detectors are placed in the roadbed between the tracks.

The radar output, as well as the other outputs derived from the motion of the freight car, are fed to the computer as DC voltages. The computer must also take into account variables due to weather. Wind and rain can affect speed.

A freight-car weighing technique in experimental use is expected to produce more exact measurements than pressure devices now used. Gamma radiation is directed at the car and weight is derived from the amount of reflected radiation.

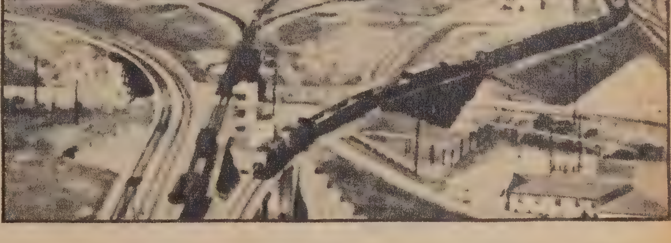
The gamma-radiation technique is also used to inspect wooden sleepers, poles and other structural units.

Radiation techniques are reportedly saving millions of dollars when applied to engine inspection. Radio-active piston rings are built into diesel locomotives to check on wear. By measuring radioactivity of oil drained from the crankcase, wear is computed rapidly and accurately without taking the engine apart.

An atomic signal lamp that glows for 12 years by its own power is another railroad innovation. The lamps use krypton 85. Early models sold for about 125 dollars; revised versions now sell for 400 dollars. They operate like fluorescent lighting fixtures.

Electronics for control and communications are helping reduce costs outside the yards, too. Until recently, the typical intercity rail route used four tracks; two lanes for inbound and two for outbound trains. The inner tracks were reserved for fast trains. Freights ran on the outer tracks accessible to sidings.

With present-day communications and detection devices, railroads find they can eliminate two tracks in each direction and rely on electronics to tell them the location of each train. Additional sidings along the new two-track routes let railroadmen route trains around each other. They get more use now out of two tracks than they did before out of four and save on personnel and real-estate taxes.



This is a typical American railway freight yard recently converted to electronic control. The New York Central yard, at Avon, discussed in the text is very similar in layout, though on a larger scale. The main control point and rolling ramp are in the immediate foreground.

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P828

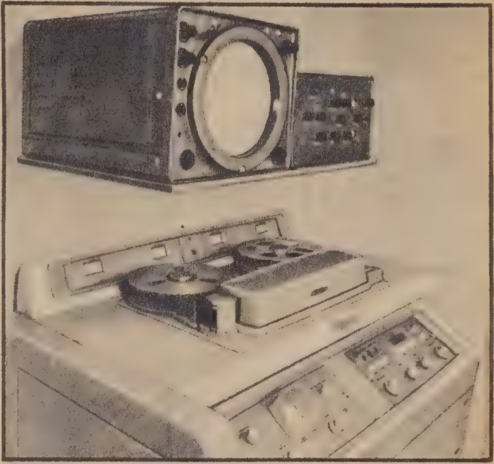
REVIEW—VIDEO RECORDER AIDS RADAR TRAINING

The ever increasing use of radar in military, civil and research applications has created a growing need for skilled radar operators. To cope with this requirement, Decca Radar Ltd., England, has developed a system which allows complex radar patterns, either "natural" or "created," to be recorded on tape for re-presentation as often as may be required.

THE complete system is a combination of an Ampex Videotape Recorder, as used by TV stations, and a standard Decca surveillance radar unit, both suitably modified for the new application.

The equipment comprises everything that is necessary for the recording of data from a surveillance radar head, including a monitor display on which recordings can be played back. Recordings can also be played back into a complete operations room system, where tracking, filtering, and all the other normal functions can be carried out exactly as if live radar data were being employed.

The recorded picture, unlike that obtained with earlier techniques such as film recording, is completely realistic and has a wide dynamic range. Investigations into the range of applications of the system have shown that it has great advantages as an aid to training, as a research instrument, and for certain operational functions; in some of these roles it is considered that it will become an indispensable item of equipment.



The complete set-up for recording radar signals on tape. The recording head and control console of the Ampex Video tape Recorder is seen in the lower portion of the picture, with the Decca PPI screen and waveform monitor above it.

COST PROBLEM

In air defence organisations the high cost of special flying for controller training is a serious embarrassment to almost every Air Force. It is, of course, necessary to give flying time to pilots and other flying staff, but the priority requirement in this type of flying is for weapon training and other specialised flying, which is not compatible with the training of ground controllers.

This therefore means that, if controllers are to be given the training and practice which they require to maintain a high standard, a large volume of special flying is required; and it will be difficult for economic reasons to reproduce in training the volume of air activity which might be expected in actual warfare.

With this recording system a record can be made of a realistic bomber attack, either by recording the annual exercise carried out by most air forces, or by a specially mounted exercise. Such recordings can be used for training early warning or tracking operators, either in conventional manual systems or in semi-automatic operations room systems. The same recording can be used for training interception controllers by flying simulated fighters against the recorded bombers.

It should here be emphasised that one of the great advantages of using recorded data for training is that the identical exercise can be repeated as many times as required. This makes it easier to show the staff under training where they have made mistakes, and also allows the abilities of different staff to be compared under identical conditions.

A most important facility offered by the system is the ability to introduce "unwanted phenomena" into the display picture in an operations room in which training is being carried out. By this means training can, in appropriate cases, be made very much more realistic than is at present possible.

On the other hand the investigation of true "unwanted phenomena" on radar displays is extremely difficult because of the impossibility, at present, of obtaining an accurate record of either the observed picture or the electrical inputs which caused it. With the Decca system, recordings can be made of such phenomena when they appear, for subsequent analysis; tne wide dynamic range of the equipment makes it especially suitable for this purpose, for which earlier types of recorder were not satisfactory.

It has been the practice for several years in air traffic control to record all ground/air/ground voice communications as an aid to the retrospective analysis of situations in which accidents or "near misses" have occurred. It is believed that in the future there will be a requirement for the recording of surveillance radar data for the same purpose.

BASIC CAPACITY

The system is capable of recording and playing back the data from a single beam surveillance radar with a bandwidth of approximately 4 Mc, together with speech within a bandwidth of 50 cs—10 kc. Modified versions can be made available for use with multi-beam or back-to-back aerial systems.

It comprises a modified Ampex VR 1000B Videotape Recorder, with equipment for the processing of the aerial bearing data, and a radar display unit which is used as a monitor during recording and playback.

The Ampex Videotape is well known, and is in wide use throughout the world for television recording. The remaining equipment is built from units of the Decca Interscan Display System, and the whole has been engineered by Decca Radar Limited. Outstanding features of recordings made with this equipment are their high accuracy and wide dynamic range: this is normally 26 db but can be increased to about 36 db if required. Dynamic ranges of these orders are unattainable by alternative methods such as film recording.

FOUR TRACKS

The equipment provides one channel for video recording with approximately 4 Mc bandwidth, one channel for speech recording (50 cs—10 kc), one track for recording aerial bearing information and a control track whose recorded square wave signal is used during playback to ensure precise alignment between video heads and tracks.

The tape employed is two-inch "Mylar," carried in 7,200ft lengths on 14-inch reels, and the forward speed of the tape is 15 inches per second. The special feature of the recorder is the use of four heads located around the periphery of a rotating drum, which is in contact with the tape so that the heads scan across the tape: the actual transverse speed of head relative to tape is 120 feet per second.

Another feature of the system is the ability to make duplicates of tape so that a standard exercise could be distributed throughout an entire organisation if so desired. Alternatively, a single copy may be circulated to any centre where similar machines are available to play it.

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REVIEW-"ROBOT" TO TEST TELEPHONES

The Acoustical Division of the French National Telecommunications Research Centre at Paris has developed a "robot" unit for inspecting the sound-reproducing characteristics of handset components. The "robot" is infinitely more accurate and efficient than the previous method of testing by human voice and ear.

THE French Postal Ministry must provide for inspection of millions of transmitter capsules in manufacturing plants. These capsules contain a loose mass of finely granuated carbon below a diaphragm in the perforated plate, into which the subscriber speaks. The vibrations of the air that onstitute the sound are transmitted through the diaphragm o the carbon granules, modify the contact between the ranules, and "modulate" the intensity of the electric current passing through them. The current thereby becomes the carrier" of the voice which it reproduces in the diaphragm f the receiver held to the ear of the called party.

The quality (volume and intelligibility) of the conversaion depends very closely on the accurate functioning of the ransmitter capsule, so the latter must be tested individually n accordance with certain well-defined standards.

SUBJECTIVE EVALUATION

As in nearly everything concerning sensory perception, he test is based on subjective evaluation by comparison. The "speaker" first pronounces the words into a master microphone and subsequently into the transmitter capsule to e inspected. The "hearer" activates a potentiometer in order to make the two auditions clearly comparable. If this equires too great a correction, the transmitter capsule tested s rejected.

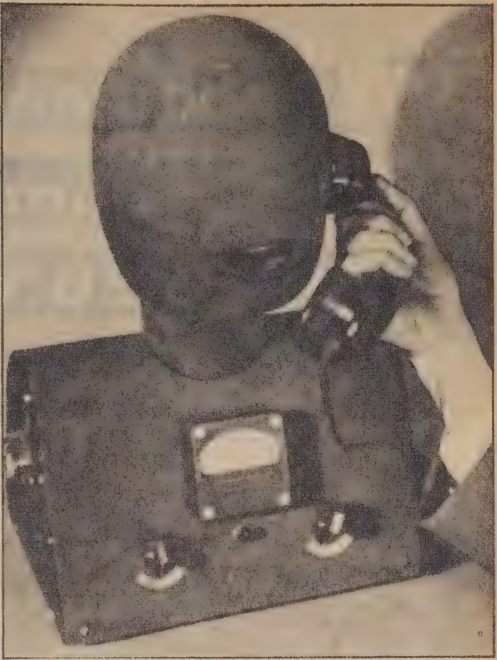
Necessarily a rather slow procedure, it seemed desirable o replace this by automatic inspection through electronic means. As a first step, it was necessary to design an artificial speaker" and an equally artificial "hearer" with constant haracteristics of emitting and perceiving sounds simulating he human voice.

The technicians therefore created a structure closely esembling the volume and surfaces of a human head. This s necessary if the voice, issuing from the artificial speech rgan, is to be emitted in all directions exactly as it would e by a human being. The hair had to be represented — rom the acoustic point of view — by a thin layer of soundbsorbing matter glued to the head. The lips and palate re of leather. The artificial voice is furnished by a small oudspeaker, placed at the end of the larynx and connected o an electrophone.

SPEECH SUBSTITUTE

Actually, real speech is no longer utilised but replaced y a loudspeaker which is powered by a current of constant tensity and variable frequency, furnished by a heterodyne enerator. The loudspeaker emits a continuous sound of onstant "volume" but with the "pitch" rising progressively rough all audible frequencies from 30 to 10,000 vibrations er second.

The transmitter capsule to be inspected "hears" this inreasingly higher pitched sound and produces a correspondng current which passes through a recording meter. If he latter traces a horizontal line, this indicates that the capule transmits sound accurately at all frequencies and will ot distort the voice of a subscriber. If the meter records pronounced humps on the graph, the capsule is rejected.

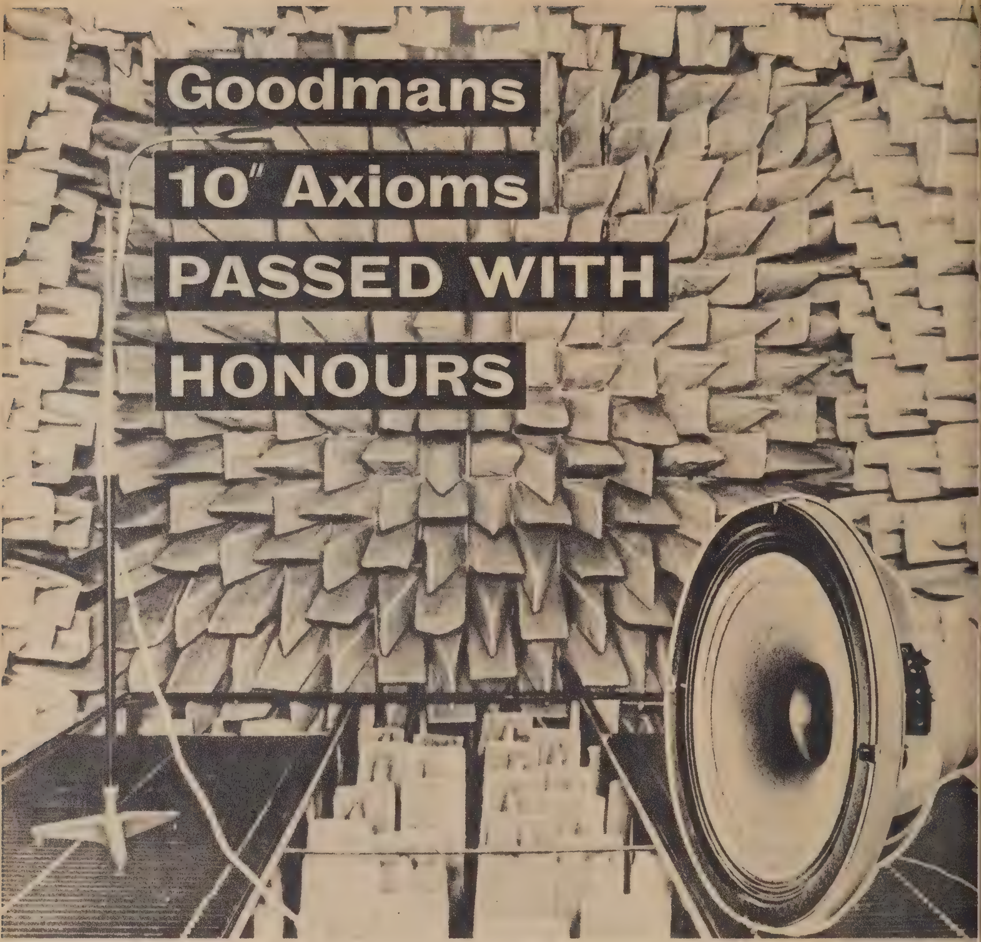


In order to exactly simulate practical conditions, test tones are fed to the transmitter through this dummy head. Note the artificial lips and tongue.

The artificial ear is used to test the receiver elements. The latter contains a small permanent magnet which increases sensitivity. The magnet attracts, with varying force, a soft-iron membrane or "diaphragm" and starts it vibrating. These vibrations are imparted to the surrounding air and so reproduce the sounds of speech.

Receiver elements are tested by applying them to the artificial ear, covered with leather, which suitably reproduces the characteristics of the external ear and the external auditory meatus. The ear drum is constituted by a calibrated microphone, electrically connected to an amplifying voltmeter which here again corresponds to the auditory nerve of the human ear. Indicated by the voltmeter, this arrangement tests the sensitivity of the receiver element which must be satisfactory at all telephone frequencies. — ("French Economic and Technical Bulletin.")

Testing the other end of the line. The receiver is held against an artificial ear containing a calibrated microphone. Due to the intimate coupling and low level, the dummy head is not needed for this test.



Goodmans loudspeakers are subjected to the most severe examination in the anechoic chamber, shown above, during both development and subsequent manufacture, ensuring that your GOODMANS HIGH FIDELITY LOUDSPEAKER has "passed with honours" and that its performance will justify your choice.

AXIOM 110
Price: £9'7'6
Power Handling : .... 10 Watts.
Flux Density : .... 12,000 Gauss.

AXIOM 112 as illustrated
Price: £15'12'6
Power Handling : ....12 Watts.
Flux Density : .... 16,000 Gauss.

BOTH UNITS have a frequency range of 40-15,000 c/s and impedance of 15 ohms.

GOODMANS

Australian Agent:

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60 Clarence Street, Sydney. BX 1571

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Address ....
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SCIENTIFIC & INDUSTRIAL NEWS

BLOOD PRESSURE CONTROL

A NEW British machine which can record and control human blood pres-
re over long periods was shown to
porters in London recently. A B.B.C.
porter who saw the machine said, "The
'inston Green Blood Pressure Follow
p instrument follows the blood pres-
re continuously, whether the patient is
onscious or not, and it does it from a
iy cell, or microphone, taped to the
itient's finger, or toe, and covered with
tube.

"Inside the tube air pressure stops the
ılse and the blood pressure is record-
l on the machine. An electronic mem-
'y, realising the pulse has stopped, re-
ases some air to start it again and it
ın go on doing this for hours with no
effects to the patient.

"This enables surgeon and anaesthetist
have a complete check on the patient
ı the operating table.

"But this British machine can also
ıntrol blood pressure by controlling
ıtomatically the flow of drugs into the
ıtient.

"The surgeon can decide at what blood
essure he wishes to operate and the
achine will keep it there by reducing
accelerating the drugs which are being
ed in the drip feed.

"At present there are only three
achines in existence. One of them
ıs been used in London for two years."

HEAT RESISTANT GLASS

A NEW form of plate glass repels intense heat. The new glass has been
signed to help in creating cool and
mfortable working conditions in steel
ills and in other industrial plants where
ense heat is generated.

Extensive experiments with the new
ıss have been carried out successfully
steel mill pulpits and open hearth
ıne cabs as well as in other conditions
ıere intense heat is encountered.

The experimental shields used in
ıse conditions are said to have held
without any failure against not only
ıat but also flying slag and splashing
olten metal.

The operation of the glass depends
the fact that it is covered with a
n transparent metallic film or coat-
ı.

The glass itself consists of a specially
npered form of Pyrex glass. The metal-
l coating, which is said to reduce the
ıount of light transmitted through the
ıss by only a very small quantity, al-
ıst literally repels the heat, causing
to bounce off from the coating so
ıt the glass itself does not become
t.

At the same time the coating is per-
ınently bonded to the glass by means
a special process, and cannot be re-
ıved even under the most stringent
erating conditions.

Corning Glass Works, 49 Crystal
eet, Corning, New York, U.S.A.

ANTI-STATIC GLASS PANELS

A NEW range of glass panels can be used to enclose large items of electronic equipment such as computers, simulator devices or other types of equipment where static electricity is troublesome. They function both as transparent windows and protective barriers against shock and corrosion.

The panels intercept static electricity with exceptional efficiency, enabling this to be led off by a conductor wire, tape, button, or clamp-on spring for grounding.

One side of the borosilicate glass is coated with a very thin transparent metallic film 0.000016 inch thick.

The glass is said to transmit 70 per cent of the visible light and to have good resistance to thermal shock.

Corning Glass Works, 49 Crystal Street, Corning, New York, U.S.A.

ADHESION METER

AN adhesion meter for determining the adhesive force holding a lacquer film to its backing which can be adapted readily for applications for other types of films and coatings has been developed in Russia.

The meter consists essentially of a screw drive device designed for separating the backing from the film, a dynamometer made in the form of a plate-spring which is connected to the metal foil base for the lacquer film and appropriate ancillary metering and recording instruments.

In connecting the dynamometer to the base for the lacquer film use is made of the plate-spring to form the moving lining of a variable condenser. This variable condenser is connected in turn with the inductance of a high frequency generator to the oscillating circuit.

At the same time a special valve voltmeter has been developed which is graduated in the units of the adhesion to be measured and this is used linked to a recording oscillograph, the latter unit being connected to the oscillating circuit of the dynamometer.

Russian Patent Class 42K,53, No. 118249. In the name of I. I. Kletchenkov.

ULTRA THIN FILM

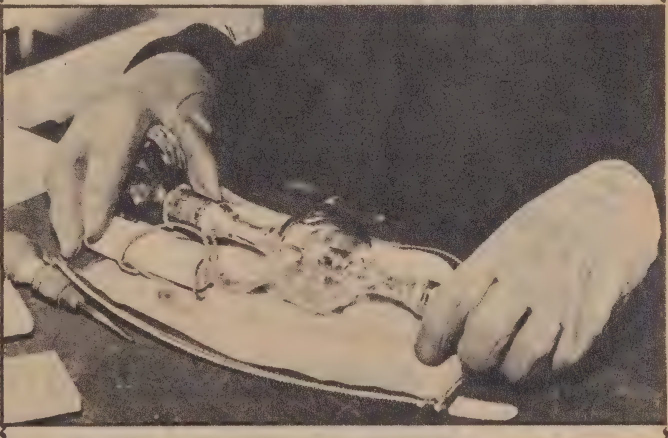
A NEW technique with an exceptionally thin photographic film which is made from nitro-cellulose and a second one a quarter-millionth of an inch thick is said to make it possible to magnify X-ray microscope pictures by about 40,000 diameters. This is a resolution of sharpness four times that obtainable previously.

The process depends on the use of an electron microscope to enlarge the images which have previously been recorded on X-ray film.

The new technique is capable of reproducing not only the extremely small

(Continued on page 31)

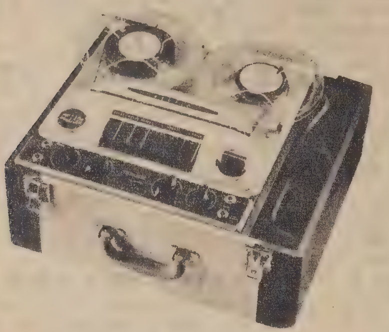
SMALL LAMP—LOTS OF CANDLES



ALTHOUGH only about one hundredth the size of a conventional lighthouse lamp, this Mazda 2Kw high pressure Xenon discharge lamp will produce three times as much light—1,000,000 candlepower. Produced in Britain by the Mazda organisation it was fitted recently to the top of Britain's famed Dungeness lighthouse for tests. If these tests prove successful this may well prove the forerunner of many similar lamps installed in lighthouses throughout the world. Note the size of one of the conducting cables, just visible under the technician's right hand.

SAVE 40% ON TAPE RECORDERS & HI-FI EQUIPMENT BY BUYING DIRECT FROM THE MANUFACTURER & IMPORTE

TR2 RECORDER BY CLASSIC INCORPORATING THE NEW COLLARO "STUDIO" DECK



Model TR2 incorporates the ne Collaro "Studio" Deck whic features:–

- **High Fidelity. Frequency response 40 to 15,000 cycles 7¼in per second.**
- **Three 4-pole shielded motors.**
- **Three speeds, 1⅞, 3¾ and 7½.**
- **Fast forward and rewind, 1200ft in 65 seconds.**
- **Two track.**
- **Light piano key controls.**
- **PAUSE CONTROL**

This has the effect of stopping the transit of the tape past the "Reco Playback" and "Erase" heads and applying the brakes to the spools wh leaving all switches and mechanical functions in their selected positio Typical application is to pause whilst recording to omit speech interpos between musical selection. Control will only work whilst it is held position.

- **TAPE MEASURE AND CALIBRATING DEVICE**

The three digit counter makes the location of any recorded passage t simplest of operations.

- **TRANSCRIPTION TECHNIQUE**

A large diameter flywheel with ground and lapped steel shaft running on ball at the bottom of long bearing reduces friction and virtually elimina "wow" and flutter at less than 0.15 per cent at 7½in per second.

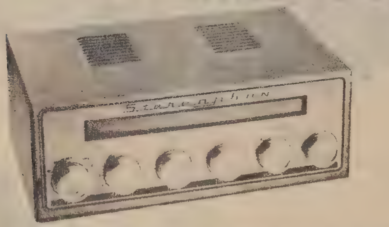
THE COMPLETE UNIT IS SUPPLIED IN ATTRACTIVE AND DURABLE TWO-TONE COVERED CASE COMPLETE WITH ACOS MICROPHONE AND FITTED WITH DUAL ROLA SPEAKERS.

The amplifier incorporates the latest "Mullard" tape recorder circuit equalised to C.C.R. standards giving perfect reproduction from recorded tapes. Outlet to power amplifier. Extension speaker outlet and "magic eye" level indicator. Amplifier is completely shielded and fitted with dress plate to match deck. Output: 4 watts Can be used as straight amplifier i frequired.

COMPLETE RECORDER WITH MIKE 69 GNS. f.o.r.

A COMPLETE HI-FI STEREO SYSTEM FOR ONLY 59 GNS. F.O.R

UNIT STEREO PLAYMASTER AMPLIFIER No. 2 WITH PLAYMASTER TUNER



—SPECIFICATIONS—

- Output 7 watts per channel (14 watts).
- Ferguson Output Transformers.
- Inbuilt tuner with new EM 84 tuning indicator, frequency coverage 550 1,600 KC.
- Valves 4 6BM8—1 12AUF—1 6N8—1 6AN7—1 EM84—2 1N1763 Rec fiers.
- Supplied in self-contained case finished in beige hammertone, with bla and gold control panel with matching knobs.
- Switching and input facilities for pick-up—radio, I.M. tuner and ta Recorder.

Also available in polished cabinet, with maple, walnut or rosewood finish 75/- extra.

PLUS THE NEW B.S.R.-UA12 STEREO CHANGER

AND TWO MAGNAVOX 8W. R. HI-FI SPEAKERS GIVING A FREQUENCY RESPONSE OF 40 TO 12,000 CYCLES

Classic Radio

245 PARRAMATTA ROAD, HABERFIELD, N.S.W. PHONE UA2145.

NEW *Releases!*

IN HI-FI TAPE RECORDERS

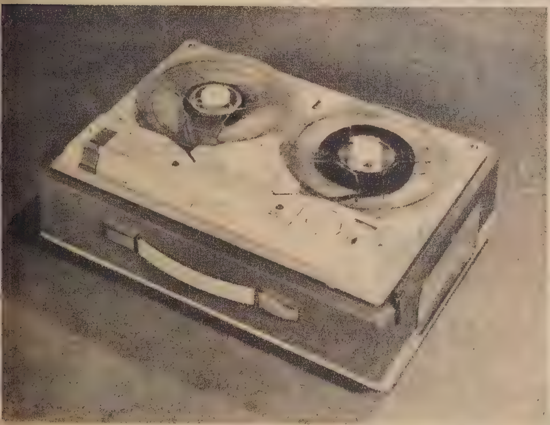
WE TAKE PLEASURE IN PRESENTING FOR THE FIRST TIME IN AUSTRALIA THIS NEW ENGLISH TAPE-RECORDER BY ROBUK ELECTRICAL INDUSTRIES, LTD. LONDON

Manufacturers of the world famous Motek Decks

The *Robuk* rk3

makes tape recorder history!

'Never-before-offered' features in a quality recorder in the medium price range



How's this for a list of tape recorder qualities

1. Three speeds—amplifier compensated at all speeds.
2. Simplified "Piano-key' operation.
3. Input for gram. and mic. have separate gain controls.
4. Monitoring through speaker, with separate monitor gain control.
5. Superimposition facilities with switch on tape deck.
6. Separate on/off switch, and tone and volume controls.
7. Full size 7" reels can be accommodated with lid closed.

Many other features

Incorporated in the tape deck are additional features such as pause control, position indicator, recording level indicator, accidental erasure prevention and automatic interlock to avoid tape spillage—fast forward and rapid rewind speeds. Sockets are also provided for extension speaker and external amplifier.

Slim design for portability

Packed for carrying, including the microphone, and 7" reel, the R K 3 weighs only 23lb! The attactively styled, two-tone case in scratchproof, washable plastic, measures only 16" x 11½" x 7" deep—a feature/quality machine!

FULLY GUARANTEED

£57-10-0 F.O.R. SYDNEY

WRITE FOR FULL SPECIFICATIONS

AVAILABLE MID-APRIL

Classic Radio

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CLASSIC RADIO TAKE PRIDE IN ANNOUNCING COMPLETE RANGE OF STEREOPHONIC EQUIPMENT

Stereophon LIVING SOUND

16 VALVE HI-FI STEREOGRAM CHASSIS

Complete tuner and amplifier for stereo, comprising a compact Hi-Fi Stereogram in two units featuring a high gain dual wave tuner with tuned R.F. stage, multi-input two channel pre-amplifier with tone controls in one unit and two Mullard 5-10 amplifiers with push-pull outputs and power supply on second chassis.

£69/15/- F.O.R.

Two pair of M.S.P. Jensen speakers or two Rola 12in dual coned speakers supplied. Power output 10 watts per channel (20 watts). Frequency response of amplifier 40 to 15,000 cycles.

THIS UNIT CAN NOW BE SUPPLIED WITH THE NEW ROLA 12 PX SPEAKERS

10 VALVE HI-FI STEREOGRAM CHASSIS

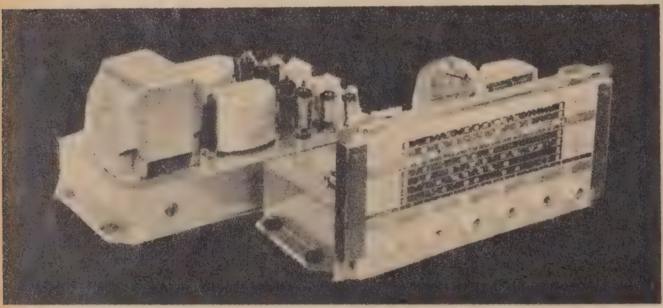
Complete stereo unit comprising dual wave tuner with tuned R.F. stage, multi-input two channel pre-amplifier with tone controls and two Mullard 3-3 amplifiers, power supply on separate chassis. Supplied with two Rola 8MX speakers. Power output 4 watts per channel. Frequency response of amplifier 40 to 15,000 cycles.

£49/15/- F.O.R.

8 VALVE HI-FI STEREOGRAM CHASSIS

Complete tuner and amplifier for stereo incorporating the "Mullard 2-2" amplifier circuit with separate bass and treble controls. Output 3 watts per channel. Supplied with two Rola 8MX speakers. Frequency response 50 to 10,000 cycles.

£41/15/- F.O.R.



ALL UNITS INCORPORATE THE NOW FAMOUS "MULLARD" AMPLIFIER & TONE CONTROL CIRCUITS.

Write for Full Specifications of STEREOPHONIC EQUIPMENT OR TAPE RECORDERS

SPECIFICATIONS OF OUR NEW HI-FI CHASSIS

NEW:

Ultramodern circuit using high gain valves including "magic eye" tuning indicator. Permatuned iron cored coils and intermediates giving excellent interstate reception and a short-wave range of 12,000 miles. All valves used are the new Mullard nine-pin Innoval series.

NEW:

Tone control and audio stages incorporating the Mullard 5/10 amplifier circuit with separate bass and treble controls giving plus or minus 15 db boost or cut at 50 cycles L.F. and 10,000 H.F., combined with push-pull output with inverse feed-back gives you really high fidelity reproduction from your radio or favourite recordings.

NEW:

Dual speaker combination using the new Jensen M.S.P. 12PR woofer with matched tweeter and cross-over network giving a frequency response of 40 to 12,000 cycles. If required the Rola 12MX speakers can be supplied (with the 8 valve stereo chassis, two Rola 8MX speakers are supplied). A.W.A. output transformers used on all units.

NEW:

Six position selector switch is incorporated in all chassis with compensation for L.P. recordings and provision for stereo F.M., or TV tuners and tape recorder.

NEW:

Large calibrated edge-lit dial in perspex (11in x 6in) with main stations of each State in prominent type. Dial fitted with counterweight drive, giving smooth tuning. Dial supplied in cream with matching knobs and escutcheon to suit contemporary blond or walnut finished cabinets.

NEW:

Sensitive "magic eye" tuning indicator (EM80) making tuning simple an positive even on interstate, overseas and country stations.
All chassis age wired for the fitting of F.M. tuner or tape recorder special plug being provided on back of chassis, also pick-up terminal and outlet for gramo. motor.
Power switch is fitted to volume control. Audio end of set can be use with TV receiver if required.

COMPLETE RANGE OF DUAL, COLLARO, B.S.R. AND GARRARD, STEREO PLAYING EQUIPMENT IN STOCK

Classic Radio

245 PARRAMATTA ROAD, HABERFIELD, N.S.W. PHONE UA2145.

parts of the nucleus, or central core of cell tissue, but also hitherto unknown features of the basic structure of a number of chemicals of industrial importance.

Dr Saara Asumaa, Physics Department **Stanford University,** Stanford, California, U.S.A.

SCREWDRIVER WITH GRIPPING ACTION

A SCREWDRIVER recently on the market is designed to ease and expedite the fitting of small screws in assembly and servicing operations. Simply pushing the tool hard into the slot of a conventional screw is enough to lock the screwdriver to the screw for positioning prior to fitting.

The locking action of the tool, which depends on a small torsion bar running through its core, is sufficient to support 4½lb from a 4 B.A. (British Association) screw.

Offered in a standard length of 5in, special lengths of the screwdriver to suit individual requirements can also be made to order.

Valtock, Regency House, 1-4 Warwick Street, W.1, England.

PRODUCING HOLLOW-WARE

A NEW machine is designed to replace the spinning lathe for many of the operations needed to produce large-diameter metal pressings.

Speed of operation will save time in the manufacture of saucepans and other sheet-metal bowl-shaped pressings and spinnings. The time required for one complete cycle is 3.2 or 6 seconds and the machine will handle a range of sizes from 12 to 28 inches diameter.

The design is basically a horizontal deck with a vertical overhead clamp to hold the pressings. With suitable tooling, all combinations of flange-trimmings or square trimming, curling and beading, ribbing and flanging or double seaming can be carried out, it is claimed.

Moon Brothers, Beaufort Road, Birkenhead, England.

LONG STORAGE OSCILLOSCOPE TUBE

INFORMATION can be stored for almost indefinite periods and later ised to give a display as required of he information by means of a new lirect-viewing storage oscilloscope tube.

The tube has two electron "guns" the irst of which "writes" information in he form of electric signals on a storage ayer or mesh. The second gun enables he stored sign to be displayed at will n the phosphor screen.

With the tube the display can be reained as long as required, and successive vave-forms can be stored and displayed ogether for comparison. The tube vhich will be available by the end of his year, is expected to be used chiefly n special oscilloscopes for displaying ransient wave-forms.

Mullard, Mullard House, Torrington Place, London, W.C.1., England.

NOVEL SOLDERING PROCESS

A NOVEL process for soldering metals has been developed in South Africa The process can be used to join any metal with the exception of black, or cast iron. Experimental tests have shown that it can be used to weld, or solder together successfully, magnesium castings and alloys of other metals containing magnesium as, for example, those included in the duralumin range.

Experiments which were carried out with ordinary sheet aluminium, which had been first tested for ultimate stress and then subsequently welded by means of the new process, showed that the strength of the aluminium sheet remained as great at the point at which the joint was made following the soldering process as the unsoldered sheet metal.

The new process is said to be relatively simple and cheap to operate.

South African Bureau of Standards, Private Bag 191, Pretoria, South Africa.

ULTRASONIC CLEANING

A 500-watt ultrasonic cleaning unit with a capacity of over six litres is claimed to cost little more than many smaller units.

The cleaner is a general purpose model, suitable for a variety of applications in the laboratory or in industry. It will rapidly clean transistor components, degrease intricate hydraulic assemblies and remove radio-active contamination from tools and instrument mechanisms.

The total energy available to the cleaner is distributed between 12 transducers, measuring in all 6 inches by 8 inches. Dead spots are thus eliminated and uniform cavitation is produced throughout the entire volume of the cleaning fluid.

Ultrasonic power is supplied by a separate bench-standing generator which delivers its peak 500-watt output from normal mains supplies.

Mullard Equipment, Mullard House, Torrington Place, London, W.C.1., England.

TV IN AFRICA

THE first permanent television service in Africa started recently when two stations in West Nigeria began program transmission.

Ibadan, the regional headquarters of Western Nigeria, has a station equipped with a Marconi 500-watt vision transmitter feeding into a three-stack superturnstile aerial, giving an Effective Radiated Power of 1¼ kilowatts. This will ensure good reception in Ibadan itself and the nearby villages.

For the studios, the same company supplied a Broadcast-Vidicon camera channel and telecine equipment with two 16mm projectors and two slide projectors.

An outside broadcast vehicle has also been supplied, equipped with two Image Orthicon camera channels. These channels, being readily demountable, can be brought into the studio when additional camera facilities are required.

The Abafon station is equipped with a 5 kW vision transmitter, and having a nominal Effective Radiated Power of 15 kilowatts, covers the towns of Lagos, Abeokuta and Ijebu Ode.

The transmitting stations are connected to the existing VHF telecommunications system to enable programs to be interchanged between the two, but most of the program material will originate at Ibadan.

12 MONTHS GUARANTEE

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An unmatched Magnetic Sound benefit. You will find dozens of advantages dealing with M.S.I., where each member of the staff is a specialist.

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The ideal machine to use in conjunction with your home movies. 2 speeds—1 for hi-fi, 1 for home movies—remote control, exclusive Strobo Disc for synchronisation. Large dynamic speaker.

PHILIPS 99 gns.

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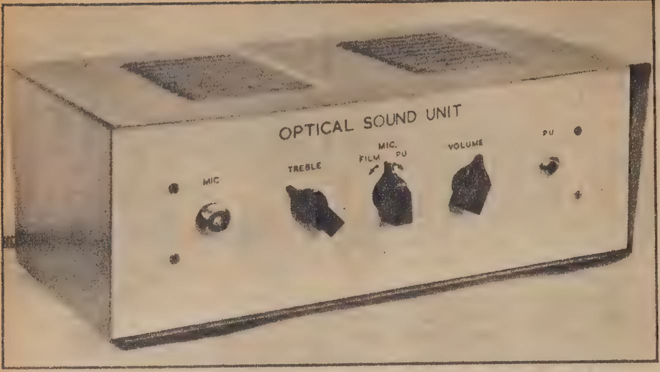
BX4440, BX4587

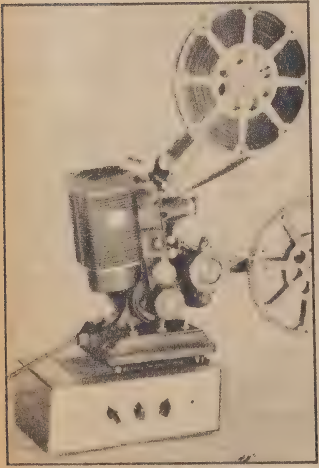


The completed amplifier is self contained, being built into a case identical to that used for the Unit Playmaster Amplifier No. 1. Provision is made for microphone and pickup inputs in addition to the normal photocell facility, and an exciter lamp supply is incorporated.

Amplifier Unit For 16mm Projectors

Presented here is a complete amplifier suitable for use with most 16mm movie projectors having optical sound heads. With inputs for microphone and pickup in addition to a compensated photocell preamplifier, it should be welcomed by anyone having a projector fitted with an old, barely serviceable amplifier.

By Jamieson Rowe



In our case the amplifier cabinet was used as a base for the projector mechanism, making the compact combination shown here. Spacers were used between the two to preserve the amplifier ventilation. Other types of projectors may or may not lend themselves to this treatment.

THIS design is a logical development from the optical sound adapter presented in the February issue, which was intended to operate in conjunction with an existing standard amplifier. By utilising this basic circuit and adding a power amplifier and power supply, we have developed the present unit. It is completely self-contained and performs all functions normally required of a unit of this type.

OBSOLETE UNITS

In developing the unit, we had in mind those of our readers who have 16 mm projectors fitted with obsolete amplifiers. Lacking in quality, perhaps, or not versatile enough for modern needs, they could well be replaced or rebuilt to modern standards.

It is often necessary to play recorded music, for instance, before or during a film program. It is thus desirable that the projector amplifier itself should be able to accept pickup input, to obviate the need for a second amplifier unit.

Since pickups generally have a peak output of the order of hundreds of millivolts, they do not require an unusual degree of amplification, and a film amplifier can usually be switched at a point of moderate signal level to serve the purpose.

Thus, with very little elaboration of the basic film amplifier, the added feature of pickup amplification can be provided. Besides allowing background music to be played between films, it allows silent films to be provided with a musical accompaniment.

The provision of a microphone pre-amplifier is not quite so straightforward. Microphones generally have much lower output than pickups and thus require a greater order of amplification. This means that at least one stage of amplification must be provided for a microphone signal before it is of the general magnitude of pickup signals.

A separate mic. pre-amplifier stage can, of course, be provided, involving at least one valve and its associated components. This has the advantage that, if needed, a mixing circuit can be incorporated in order to mix the mic. signal with that of the pickup or film track.

COMPLICATION

While this would seem, at first glance, to be a useful feature, it does involve complication and what starts off as primarily a portable 16mm optical sound amplifier can end up as a much more complex "universal" type.

The complexity can also extend to the controls and it is noteworthy that commercial practice quite obviously tends to simplicity in this respect.

As it transpired, we found that we could provide microphone amplification in the absence of film signals quite easily, by feeding the microphone into the second stage of the film pre-amplifier, and switching in an additional cathode bypass capacitor to smooth the response. (You will remember that the pre-amplifier, which was described in the February issue, incorporates partial cathode bypassing to provide part of the treble boost needed for film reproduction.)

This meant that we obviated the need for a separate mic. pre-amplifier valve, since we used one of the valves already in the amplifier. However, it also means that the two channels cannot really be played together, since the microphone will sound very peaky when played through the common stage having only partial bypassing to satisfy the film requirements.

This, as we stated before, is not important in practice. What is important is that the amplifier will perform three functions—amplify film, microphone or pick-up, according to the setting of a selector switch.

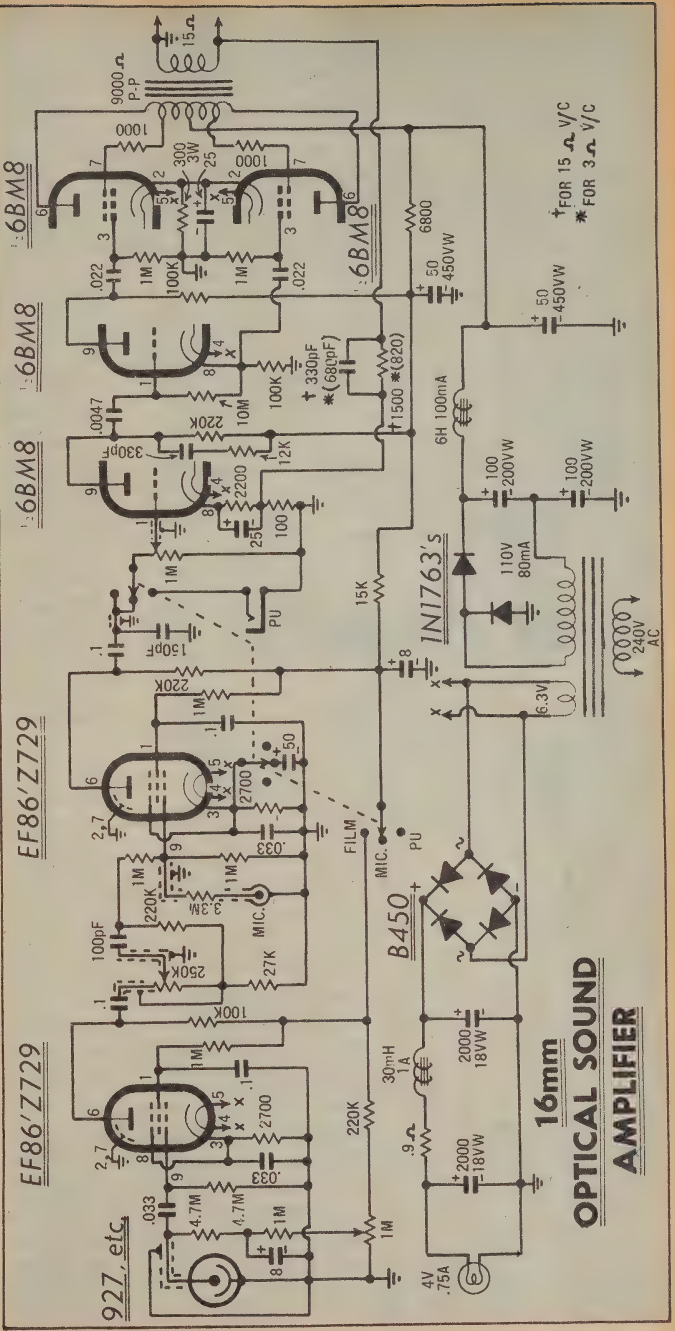
CIRCUIT

Having made this preliminary explanation, we can turn to the actual circuit. (For a more detailed discussion of the features of the basic optical sound pre-amplifier and the specialised tone equalisation involved, refer to the article in the February issue.)

The first pre-amplifier stage is identical to that of the previous adapter and incorporates an EF86/Z729 valve as before. Following it, we have the treble-boost circuit, which allows up to 18 db of additional boost to be added at 5 c/s. This feeds into another EF86/729 valve, which acts also as a microhone pre-amplifier.

As in the first stage, this stage has artial cathode by-passing to provide eble boosting when reproducing film. owever, so that the response of the age as a microphone amplifier shall ot be peaky, the extra by-pass capacior is switched in for the microphone inction. This makes the response quite evel, as mentioned.

You will notice that there is a 3.3 eg resistor in series with the microhone input. This resistor serves two urposes. One is to provide the mic. ith a load resistance of approximately


16mm OPTICAL SOUND AMPLIFIER
6BM8
6BM8
6BM8
6BM8
EF86'Z729
EF86'Z729
927, etc.
1N1763's
B450
9000 Ω P-P
15 Ω
1000
1000
300 3W
25
6800
50 450VW
50 450VW
.022
.022
1M
1M
100K
100K
330pF
(680pF)
1500
(820)
10M
220K
.0047
330pF
12K
2200
25
100
6H 100mA
100 200VW
100 200VW
110V 80mA
240V AC
6.3V
1M
15K
PU
PU
150pF
.1
8
220K
1M
.1
50
2700
2,7
.033
FILM
MIC.
1M
1M
220K
3.3M
MIC.
100pF
250K
27K
.1
100K
1M
.1
2700
30mH 1A
2000 18VW
2000 18VW
.9 Ω
220K
.033
4.7M
4.7M
1M
1M
8
4V .75A
† FOR 15 Ω V/C
✱ FOR 3 Ω V/C

PARTS LIST

1	Power transformer, 110 volts at 80 mA, 6.3 volts at 2.25 A.
1	Chassis 11¾in x 7½in x 1½in.
1	Case, internal dimensions 12¼in x 4½in x 7¾in deep. Rear to be of perforated metal. Top to be louvred, with holes in underside of case. The depth of the top to exceed that of the bottom by ½in, i.e., to be 8¼in overall.
1	Front panel with rolled edges to fit internal dimensions of case.
1	Filter inductor, 6H at 100 mA.
1	Low tension inductor, approx. 30 mH at 1 amp.
1	Selenium bridge rectifier, type B450 -1-1 or similar.
1	Output transformer, primary 9000 ohms P-P, with screen taps and secondary to suit speaker.
1	Rotary switch, 3-pole 3-position.

VALVES AND DIODES

2	EF86/6BK8/6267/Z729.
2	6BM8.
2	1N1763, OA210, FST1/4, etc.

CAPACITORS

2	100mfd 200vw electrolytics, one insulated. (Chassis mntg).
1	Dual 50-50 mfd 450vw chassis mounting electrolytic.
2	8 mfd 300vw electrolytics.
2	200mfd 18vw electrolytics.
1	25 mfd 25 vw electrolytic.
2	25 mfd 3 vw electrolytics.
4	0.1 mfd 400 vw paper.
3	0.033 mfd 400 vw paper.
2	0.022 mfd 400 vw paper.
1	0.0047 mfd 400 vw paper.
2	330pF 400vw plastic
1	150pF 400vw plastic
1	100pF 400vw ceramic

RESISTORS

1	10 meg ½ watt.
2	4.7 meg ½ watt.
1	3.3 meg ½ watt.
6	1 meg ½ watt.
4	220K ½ watt.
3	100K ½ watt.
1	27K ½ watt.
1	15K 1 watt.
1	12K ½ watt.
1	6.8K 1 watt.
2	2.7K ½ watt.
1	2.2K ½ watt.
1	1500 ohm ½ watt.
2	1000 ohm ½ watt.
1	300 ohm 3 watt.
1	100 ohm ½ watt.
1	0.9 ohm (or 1 ohm and 10 ohm in parallel).
2	250K log pot.
1	1 meg. log pot.

SUNDRIES

2 shielded mic. connectors, 2 jacks, 1 4-pin socket and plug, 4 miniature 9-pin sockets (one shielded), 2 2-lug tagstrips, 1 3-lug, 3 5-lug, 1 6-lug, 1 7-lug and 1 8-lug tagstrips. Nuts, bolts, solder lugs, grommets (7), length of 3-core mains lead and plug. Supply of 18 gauge tinned copper wire, and length of co-axial microphone cable (PT9M or similar).

Frequent model changes to stimulate sales have never formed part of the Ferrograph policy. Indeed, it is very significant that in its external appearance today's instrument still bears a very strong resemblance to the original Ferrograph of 1949. The fact that even after eleven years it has not been found necessary to make any substantial changes is obvious proof of the soundness of the Ferrograph basic principles of design.

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no gimmicks!

Today, when keen competition among manufacturers of Tape Recorders is stimulating interest in 4-track heads, slower tape speeds, cassettes and the like, it is appropriate that we should once more re-state the Ferrograph policy.

Because *Recording* is our business, the unceasing efforts of our engineers will continue to be directed towards perfection in the recording function of the Ferrograph rather than attempting to foster its adoption as a competitor to the gramophone.

Those who have bought the Ferrograph in the past have deliberately chosen it for its incomparably high standards of performance and for no other reason. Among them we number many of the leading personalities in the world of music and drama, radio and television broadcasting organisations, Government departments, record manufacturers and in fact all who demand the highest attainable standards of quality and dependability.

Based upon our intimate knowledge of the work being carried out on the Ferrograph, we believe that any widespread introduction at the present time of narrow tracks and slower speeds could lead to a general, and regrettable, deterioration in the standards of tape recording.

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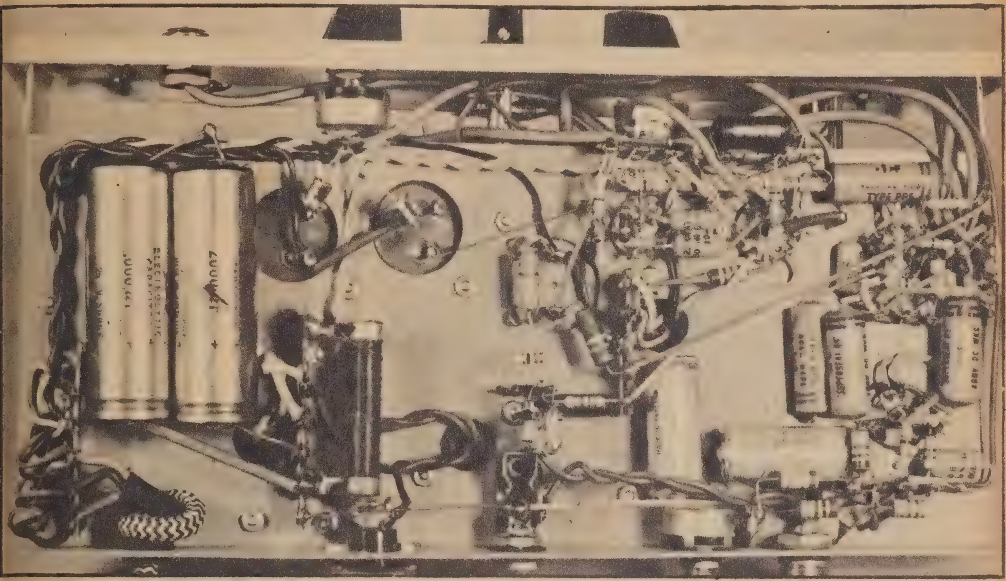
UNDERCHASSIS VIEW SHOWS WIRING, COMPONENTS



Visible in this underchassis photograph are all the minor components. Note the use of tagstrips, where possible, to support components and wiring. The four pin socket at the lower left supplies the exciter lamp, while the jack to the right is used for the speaker connection.

4 megohms, which enables it to develop as much low-frequency signal as possible. (This remark assumes the use of a crystal microphone, which is the type one would normally choose.)

The other purpose is to isolate the unswitched mic. input from the grid, so that the largely capacitive mic. does not shunt the film signal in the film function. This enables the mic. to be left connected to the amplifier if desired, without affecting operation to any extent.

Naturally enough, the series resistor attenuates the mic. signal, due to voltage divider action. Thus, if a very low output microphone is used, difficulty may be experienced in providing sufficient gain. If this is the case, the resistor may be removed, but the microphone will have to be disconnected when film is being reproduced.

QUESTION

Incidentally, you may ask, "Why not save all this fiddling around with the microphone and preamp circuitry by merely putting in a signal switch at the grid of the second EF86?" A good question, but the answer is this: Frankly, we don't like the idea of switching low level, high impedance circuitry such as this. It can lead, all too easily, to hum and feedback problems. If we can do the same job without sacrificing quality and versatility, we prefer to do it the other way.

From the output of this stage the signal proceeds to the selector switch, where the signal from the pickup jack also appears. The selected signal is then applied to the volume control potentiometer, after which it passes through the main amplifier.

The main amplifier is very similar to those used for each channel of the "Unit Stereo Amplifier No. 2," of August, 1960, and uses two 6BM8 triode-pentodes in a push-pull circuit. This economical feature, while involving only a minimum number of components, enables the amplifier to supply more than seven watts of audio when required. This means that the unit may be used in halls of moderate size without fear of not having enough sound.

STEP CIRCUIT

As in the stereo amplifier, there is a series capacitor-resistor step circuit in parallel with the plate load of the first triode stage. This is to reduce the loop gain at very high frequencies and minimise the risk of instability.

As shown, the circuit is wired for 15 ohm output impedance, and voice-coil to cathode negative voltage feedback amounting to about 13 dB is connected. For readers wanting to use speakers of the 2-3 ohm class, the feedback components should be changed to approximately 820 ohms and 680 pF, and all connections made to the 3-ohm tap on the transformer secondary.

The power supply is a full-wave doubler-type, using two 1N1763 silicon diodes. Filtering is performed by a 6-henry inductor and a 50 mfd electrolytic capacitor. As before, a selenium bridge rectifier and filter network supply the exciter lamp with 4 volts D.C., derived from the 6.3 volts heater line.

This will not be required if an exciter lamp supply is already built into the projector, and may thus be omitted.

As before, the voltage applied to the photocell for polarisation is controlled by a potentiometer. This is fitted with a screwdriver slot and mounted on the back of the chassis, so that it may be readily adjusted. Note, however, that the filter circuit between the pot. and the cell has a rather long time-constant, and small adjustments are delayed in their effect by a matter of seconds.

As the photographs show, we have been able to fit the complete amplifier into the same case and chassis used for the previous adapter (not without a bit of careful planning!). The construction used is the familiar panel-and-bracket chassis type popular at present.

Conditions are not unduly crowded, however, and adequate space is left for ventilation and cooling.

On the front panel, looking from left to right, there is the microphone socket, then the treble control. In the centre is the function switch and finally the volume control and pick-up jack. The photocell and exciter sockets are accessible from the rear, as they are not usually needed during operation.

ABOVE CHASSIS

Above chassis we have most of the major components. At the far right is the power transformer, with the high-tension filter inductor in front (partly hidden). Then the low-tension rectifier and inductor, with the voltage doubler capacitors in front. In the centre is a dual 50-mfd electrolytic used for decoupling.

To the left of this is the output transformer, with the two 6BM8s to the front of it; and at the far left of the chassis, the two EF86s.

In the photograph, it can be seen that the first EF86 is not fitted with an external shield. This was done because

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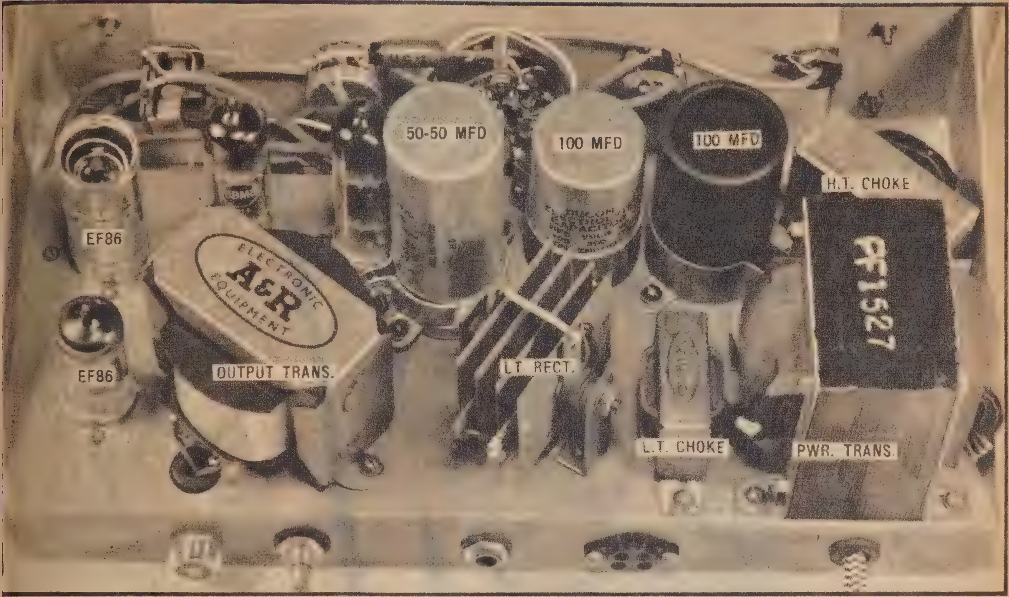
REAR VIEW SHOWS LAYOUT OF COMPONENTS



Here is the rear of the amplifier, with the case removed. At the far left may be seen the preamplifier valves, followed by the two 6BM8's and the output transformer. The LT rectifier and choke follow, with the three large electrolytics behind. Finally, we see the power transformer, with the filter choke partly obscured behind it.

he valve was found to be less noisy without the shield. While this may nly be a peculiarity of the valves we ried in this position, we mention it here for your consideration.

As the valve has a considerable mount of internal shielding, little harm s done by running it without the extra shield. When mounted in the main amlifier case, no difficulty should be exerienced with hum pick-up at all.

Along the rear of the chassis, there is he exciter supply socket at the right, ollowed by the speaker jack. Then rouped together at the left are the hotocell voltage adjustment and the hotocell input.

The low-tension filter capacitors are mounted beneath the chassis, at the far eft. The position of many of the minor omponents can be ascertained from the nderneath photograph.

COMPONENTS

It is essential in a project of this type o use as many subminiature components s possible, otherwise extreme difficulty will be experienced in fitting everything n the available space. Thus resistors nd capacitors should not be chosen in high-rating types "just to be extra safe." Ratings should not be over-run, of course, ut serious under-rating becomes unconomical of space.

In the prototype, we have used a imple point-to-point wiring technique, with a reasonable number of tagstrips o provide adequate support for compoents and joints.

At the far left of the chassis there is 6-lug tagstrip, used to anchor the mains ead and to terminate the transformer H.T. leads. Adjacent to the exciter supply socket, there is another tagstrip; this time a 7-lug type, used to support the 0.9 ohm resistor and to terminate the heater and low-tension D.C. wiring.

At the front of the chassis next to the voltage doubler capacitors is a 2-lug strip, used to support the two silicon diodes. Another 2-lug strip is used adjacent to the speaker socket to support the negative feedback components and the cathode circuitry of the first 6BM8 section.

LAYOUT

Close to this, a 5-lug strip is used to support the screen stoppers of the two 6BM8s, as well as the pre-amplifier decoupling components. The rest of the 6BM8 circuitry is supported where necessary by an 8-lug strip to the front of the two valve sockets.

The lug on the very left end of this strip is used as a tie point for the high tension of the triode sections of the two 6BM8s, and is coupled directly to the lug fourth from this end. The plate load of the phase splitter meets the end lug, whereas the plate load of the other triode goes to the fourth lug. The step circuit attached to this triode is wired using the third lug as support, i.e., the 12K resistor between plate pin and lug 3, and the 330 pF capacitor between lugs 1 and 3.

The second lug from the left end is the earth foot, and is linked to the centre spigot of the adjacent 6BM8 socket. The 1-meg grid leak of this valve also goes to this lug.

The two output cathode pins are directly linked, and also joined to the fifth lug from the left end of the tagstrip. From this lug the two cathode components are taken to the earthed seventh lug, which is also joined to the centre spigot of the nearest 6BM8. In addition, the earthed shield braids of the last EF86 output and first 6BM8 input leads are earthed here.

The sixth lug of the tagstrip is left unused, while the eighth is used as a tie-point for the output of the last EF86 stage. Meeting here are the 0.1 mfd coupling capacitor from the EF86, the lead to the function switch, and the 150 pF capacitor to the earthed seventh lug.

Rearward of the first EF86 socket, a 5-lug strip is used to mount the photocell and valve supply components. The left-hand lug is used for the high tension point, and is connected to the switch. To it are soldered the plate and screen resistors of the EF86, and the 220K resistor in series with the cell voltage pot.

CELL SUPPLY

The second lug is used to support the filter components of the cell supply, and is thus bypassed to earth by the 8 mfd electrolytic. Also soldered to it are the 1 meg resistor from the moving arm of the pot. and the 4.7 meg cell load, going to the fifth and end lug of the strip.

The centre lug is earthed, and is connected to the centre spigot of the EF86. The earthy side of the cell connector (which is otherwise insulated from the chassis by a short plastic strip and two fibre washers) is also taken to this earth point, as is the 4.7 meg grid leak and the 0.033 mfd cathode bypass.

The earth braid of a small piece of PT9M cable used to connect the cell connector to the fourth lug is also earth

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ed at the third lug. (Note that the other end of this braid is cut off and insulated, NOT joined to the earth side of the connector. The connector is already joined to the third lug of the tagstrip, and a parallel connection via the braid may cause hum.)

The fourth and fifth lugs on the strip are paralleled, and receive the 4.7 meg cell load from the second lug, the 0.033 mfd capacitor from the EF86 grid, and the inner conductor of the lead from the cell connector.

Another 5-lug strip is used at the right of the second EF86 socket to mount most of the circuitry associated with this stage. The first lug from the front end is used as a termination for the high tension for the stage, and is joined directly to the supply lug on the 5-lug strip near the centre of the chassis.

A lead is also taken from this first lug to the function switch, as part of the high tension circuit of the cell and first EF86. In addition, the plate and screen resistors of the second EF86 join here.

TREBLE CONTROL

The second lug from the front is used to terminate the inner conductor of the shielded lead from the moving arm of the treble control, whose earth braid connects to the third (earthed) lug. The only other connection to the second lug is the 100 pF capacitor, which leads to the left end lug of the 3-lug strip just rearward of the valve socket.

The fourth lug from the front is used as a tie-point for the outer conducting braid of the lead going to the top of the treble control from the fifth lug. NOTE that the braid of this lead is no earthed, but is joined at the tagstrip to the earthed centre lug by a half-watt 27K resistor. (In other words, the lower end of the treble control is connected to the underchassis circuitry via the outer braid of the lead.)

The fifth lug of the strip, as said above, terminates the inner conductor of the treble control lead. To it also is connected the 0.1 mfd coupling capacitor from the plate of the first EF86.

The left end lug of the small 3-lug strip rearward of the second EF86 socket (to which the 100 pF capacitor mentioned above connects) is used as a tie-point for two resistors. One is a half-watt 1 meg unit from the grid of the EF86 and the other is a half-watt unit from the fourth lug of the adjacent 5-lug strip.

The centre lug of the 3-lug strip is earthed via its foot and is also tied to the centre spigot of the EF86 socket. Joined here also is the end of a 1 meg resistor from the EF86 grid, in addition to the 0.1 mfd bypass from the screen of the first EF86 and the outer braid from the microphone connector lead.

The third or right-hand lug of the strip is used to terminate the inner conductor of the lead from the microphone connector. From the lug a 3.3 meg half watt resistor goes to the grid pin of the EF86 socket.

The rest of the wiring should be easily identified from the underchassis photograph, by referring to the circuit diagram.

A point to remember when switching on the amplifier for the first time: If you are greeted by an extremely loud "howl," it most probably means that the output transformer has been phased so that the feedback is positive instead of negative. The correct phasing will have to be found by trial and error.

The procedure to follow is this: If it howls, disconnect the feedback, which should stop the howl. (If it doesn't, there is something else wrong.) Switch off and reverse the connections to the secondary of the output transformer by earthing the end of the winding which previously connected to the feedback, and connecting the end which previously was earthed, to it. On switching on again, all should be well.

As the photograph on the first page of this article shows, we used the amplifier case as a base for the projector mechanism. This is quite satisfactory, as the case shown is sufficiently rigid to support the weight of the projector used.

MAY NOT SUIT

Other machines may not lend themselves to this style of construction, however, and the exact mounting used in each application will depend on circumstances and personal choice. Some readers may prefer to place the amplifier beside the main projector mechanism, but remember that the lead to the P.E. cell must be kept as short as possible and run in very low capacitance cable.

For the benefit of readers wishing to duplicate our style of construction, we would add that it is wise to mount the mechanism on metal spacers at least 3/8in long, to allow clearance of the ventilation louvres on the top of the case. Not only is mechanical clearance assured in this way, but ventilation will be improved in addition.

This completes the description of our film amplifier. It should find ready application in the field of not-so-new 16mm film equipment, for the production of high-quality sound from optical track films.

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Reverberation Time: 0.5 to 3 seconds.

Inputs: One microphone channel with mixing facilities and independent bass and treble controls. One high-level input for electonic instruments.

MODEL S NG 51.

Operation: by continuous magnetic tape loop, and up to 6 magnetic heads. Reverberation is controlled by the mixing of the outputs from several heads, each of which is variable independently.

Reverberation Time: from 0.1 to 3 seconds.

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Here's your answer, Tom!

This month we are discussing high frequency oscillators, first in theory and then in practice, how they are modulated, and how they form the basis of the service oscillator and signal generator. The subject is introduced with an explanation of the tuned circuit valve oscillator from a negative resistance viewpoint.

by Jamieson Rowe

THE heart of any tuned oscillator is its tuned circuit, as the name would imply. Therefore, before we consider anything else, we should look at the tuned circuit and the derivation of an oscillator from it.

The most common type of tuned circuit used in electronic oscillators is the parallel type, which has a maximum impedance at a unique finite frequency called the resonant frequency. The basic parallel tuned circuit is shown in Figure 1 (a).

If due to some disturbance, a small current is produced somewhere in the circuit, it will oscillate. Energy will alternately be stored in the capacitor and the inductor, the interchange taking place at the resonant frequency. Naturally, during each interchange some of the energy will be absorbed by the circuit's resistance R, which may be represented as shown by the dotted lines. (Reactive elements store energy, while resistive elements dissipate it as heat.)

DECAYING

If we were to observe the circuit voltage E during this time, it would appear like the decaying oscillation or wave-train shown. The lower the losses of the tuned circuit, the higher the effective value of R, and the slower the decay of the oscillations. Thus, if there were no losses, the resistor R would have an effective value of infinity, and the circuit would oscillate indefinitely.

The circuit shown in Figure 1(b) does, in fact, allow oscillations to continue indefinitely. It does so in the following way:

Examination of the circuit will show that the tuned circuit is so arranged that the voltage E is the grid-cathode voltage of a triode valve. When a disturbance occurs and the tuned circuit oscillates the amplifying action of the valve produces a corresponding oscillatory variation in the plate current of the valve.

TICKLER COIL

The valve plate current is passed through a feedback or "tickler" coil which is placed near the inductor of the tuned circuit. The two coils are arranged so that the magnetic field from the feedback winding aids or boosts that of the tuned circuit coil L. When the magnetic field of L is collapsing and the stored energy transferring to the capacitor, for instance, the feedback will be causing a field which aids the collapse.

The whole idea of the valve and feedback circuit is to arrange for the tuned circuit to be continually supplied with little "boosts" of energy to make up for that used by the circuit resistance. If the tuned circuit were perfect, and was composed of lossless capacitance and inductance, this would not be necessary, for the circuit oscillation would never decay.

Note that it is the tuned circuit which oscillates, NOT the valve. The valve and feedback arrangement merely ensures that the tuned circuit oscillations are maintained, by supplying it with energy to replace that dissipated by the loss resistance.

Another way of explaining the operation of the valve circuit is by using the idea of negative resistance. Negative resistance is a quality exhibited by a circuit or circuit element when the current flow through it DECREASES rather than increases with an increase in applied voltage. There are no practical devices which act as negative resistors under all conditions, but many devices behave in this way over a limited range of conditions.

The circuit which we have been discussing can be considered to act as negative resistance, shunting the tuned circuit. In other words, the valve and feedback circuit behaves as would a negative resistor shunting the tuned circuit. And how does negative resistance sustain the oscillations? Because it effectively cancels out the loss resistance of the circuit.

The formula for finding the resultant resistance of two resistors R1 and R2 in parallel is:

$$R = \frac{R1 \times R2}{R1 + R2}$$

Now if one of the resistors is negative, we get some odd answers. For instance, if the negative resistor is the same size as the positive one, the result is infinity, because the bottom of

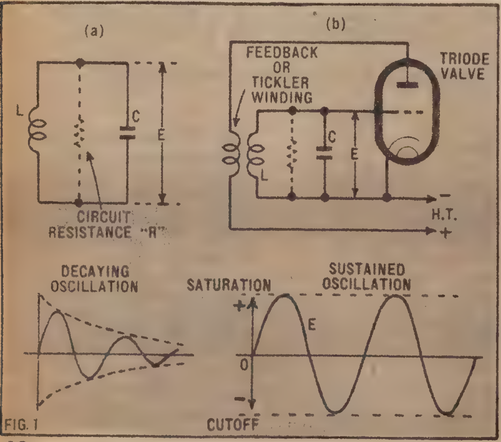


FIG. 1

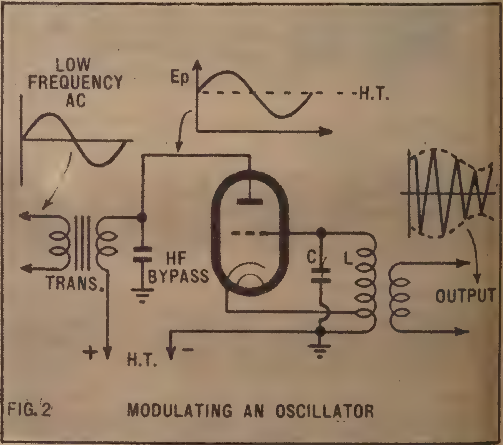


FIG. 2 MODULATING AN OSCILLATOR

e fraction disappears. If the negative sistor is the smaller, the answer is egative, and if the positive resistor is e smaller the answer is positive.

The first result is the one which ex-lains the operation of the oscillator. /e previously said that if the circuit sistance could be made infinitely high, would not load the tuned elements y dissipating energy. Now we have und that all we have to do to get an finite resistance is to shunt a posi-ve one with an equal negative one.

This is how the valve and feedback rcuit maintains the oscillations — by ting as a negative resistor equal in agnitude to the loss resistance of the ned circuit. The resultant loss resist-ce is thus infinity, so the circuit oscil-tes continuously.

VHAT LIMITS THEM?

You may ask, "Why don't the oscil-tions grow enormously large? In other ords, why doesn't the feedback over-ncel the losses? How is the negative sistance made to exactly cancel out e positive, with none left over?"

This is a very good point, and the swer lies in the properties of e valve. A valve will not amplify an NLIMITED voltage applied to the id. If an alternating voltage is ap-ied which swings the grid positive for rtion of the cycle, amplification ceases r that portion, as a positive grid has control in a normal valve. (We say at the valve draws grid current under sitive grid conditions, and the valve said to be SATURATED.)

If the alternating grid voltage drives e grid so far negative during a portion the cycle that the valve electron eam is cut off, amplification action ain ceases. Naturally enough, the grid nnot control the stream when there n't one! Under these conditions, the lve is said to be cut off, with the grid llow the cutoff voltage for that valve d conditions.

Thus in the circuit which we have en considering, the valve ceases to plify during the complete oscillatory cle once the tuned circuit voltage ows to a size where cutting off or uration occur during part of the cle. When this happens, the feedback ergy drops.

The circuit thus reaches a steady os-ation level just on the verge of sat-ation and/or cut-off of the valve at peaks of the oscillation, as the etch of the circuit voltage E indi-es.

ANY CIRCUITS

There are many types of tuned oscil-or circuits, but they all operate in a ilar manner to this. One which we ve been discussing is known as a "ate Tickler" circuit. Other common cuits are the Grid Tickler, the Tuned te-tuned Grid, the Hartley, the Col-s and the Clapp. They mostly dif- in the way in which the feedback is anged.

All these oscillators come under the ss of unmodulated oscillators. If e of the oscillatory energy is tap- off, they can be used to supply high-quency (usually) alternating voltages various purposes. Uses which spring mind are alignment marker genera-s for TV, local oscillators for super-erodyne receivers and carrier oscil-rs for transmitters, and a whole host others.

For many purposes, however, it is necessary to vary or MODULATE the amplitude of the high-frequency output of the oscillator. This is necessary when the high-frequency signal is required to act as a carrier of information.

The circuit shown in Figure 2 is basically a Hartley type oscillator circuit. This circuit achieves feedback by tapping the valve cathode into part of the tuned circuit winding. This has much the same effect as the separate plate tickler winding of the previous circuit. The plate is connected to earth by a capacitor, so that as far as the actual oscillator circuit is concerned, it is at earth potential.

As far as low frequencies and direct voltages are concerned, however, the plate is at a relatively high impedance with respect to earth. If, instead of being connected directly to the plate voltage supply as before, it is taken through the secondary of a transformer, it allows us to modulate the amplitude of the circuit oscillations.

MODULATING SIGNAL

We can do this by applying a suitable modulating signal to the primary of the transformer. This has the effect of causing the plate voltage of the oscillator to vary in size with the modulating signal. As the amplification of the valve is affected by the plate voltage, this causes the oscillations to be modulated.

Thus, if we tap off some of the oscillatory energy (in this case by means of a secondary winding adjacent to the inductor L), it will appear similar to the sketched waveform.

There are many other methods of modulating oscillators, but they all produce the same effect — variation of the magnitude of the high frequency or "R.F." (Radio Frequency) waveform. The method shown is called transformer plate modulation.

(Note: The type of modulation which we have been discussing is called Amplitude Modulation (A.M.), for obvious reasons. There are other kinds of modulation which we will deal with in due course in other articles.)

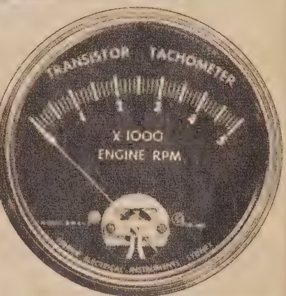
The usual "Modulated Oscillator" seen on the service bench works exactly in the way we have been discussing. To vary the oscillation frequency the constants of the tuned circuit are altered (usually by using a variable capacitor for fine adjustments, and switching coils for coarse adjustments). The modulation signal is usually provided by another valve oscillating at about 1,000 cycles, and the output voltage of the instrument varied by a potentiometer or series of switched resistors.

When the instrument is fitted with very efficient shielding and an elaborate output control or "attenuator," it becomes possible to control accurately the output, which may be registered by a meter circuit. Such an instrument would normally be provided with a control to vary the amount of modulaton applied, also with a meter to permit exact adjustment.

Other refinements would include careful ventilation of critical circuits, plus special "negative temperature coefficient" components to ensure the maximum possible stability with changes in temperature. Power line fluctuations also would be guarded against by voltage regulator devices, and the overall frequency and amplitude stability of the instrument should be extremely high.

Only an instrument with at least these features qualifies for the regal title of "Signal Generator" — meant to signify that it is more reliable, accurate and versatile than a normal modulated oscillator. However, it is not unusual to find the title applied in advertising literature to the humblest of modulated oscillators!

This completes the discussion of modulated oscillators and signal generators, Tom. Next month we will discuss audio oscillators and generators.



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Can be wired to switch circuit on or off. 3/9

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12K8	10/
EK32	6/9
6SA7GT	9/6
6SH7	5/6
1Q5G	2/6
1P5G	2/6
1C7G	3/
1K5G	2/6
1M5G	3/
1K7G	3/
1L5	9/6
6C8G	5/
6SS7	8/6
6H6	2/6
6H6GT	2/6
6K7GT	7/9
6U7G	5/
6J7G	5/
7C7	3/6
78	7/6
6B6G VR55	5/
VR65A	2/6
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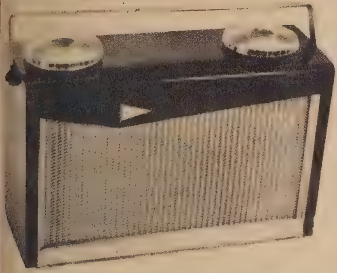

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FROM THE SERVICEMAN WHO TELLS

Should TV aerial masts be earthed? If so, what size conductor should be used and how effective will it be? These, and similar questions which I raised in the January issue, form the basis for further discussions this month. I also have an interesting workshop story concerning an audio amplifier.

ARISING out of my article in the January issue, concerning the risk of lightning striking TV receivers, I received the letter reproduced herewith. It is from a fellow serviceman in a typical fringe area, and I suggest you read it before proceeding further.

Having read it, I think you will agree that it raises some very pertinent points. The first is that fringe area installations present a special problem by reason of the higher masts invariably required.

WHAT SIZE CABLE?

Next, if it is agreed that such masts should be earthed, our friend raises the question as to what size cable should be used for the job, and suggests that the instantaneous current produced by a lightning strike may be as high as 90,000 amps.

Acting on that basis, he has chosen an earth wire of considerable size (37 strands of 14 B and S is a lot of cable), even though he has calculated that it would fuse at something like 3,500 amps —a mere fraction of the anticipated figure. And he is obviously bewildered by the apparent impracticability of carrying his calculations to a logcal conclusion and fitting a cable to carry 90,000 amps.

(No mention has been made of the time required for the 37/.064 cable to fuse at 3,500 amps, and it may well carry more than this if the discharge is brief enough. However, I doubt whether this will alter the situation a great deal.)

Since writing the January article I have been trying to gather as much information as possible on this whole subject, since it seemed that very little worthwhile information had been published so far. While time did not permit me to probe as deeply as I would like (after all, I have to earn a living in my spare time), I was able to collect some useful points.

OPINIONS SOUGHT

Apart from individual servicemen with whom I discussed the problem, I tackled two of our largest TV aerial manufacturers. Then, following their suggestions, I also approached the Australian Standards Association, an organisation responsible for determining what appears to be the best practice in cases such as these.

I was interested — though not particularly surprised—to find that, at the time of writing, no firm standards have been laid down. However, a draft proposal has been issued to those most vitally interested and, on the basis of comments which will be forthcoming, it is hoped to issue a more permanent set of proposals very shortly. In fact, it may well be that a decision will have been reached by the time this appears in print.

The two major points likely to be covered seem to be (1) whether the aerial mast should be earthed, and, if so, by what means, and (2) whether or not lightning arresters should be fitted.

In regard to (1) it is tentatively recommended that all TV aerial masts should be earthed, using normal 7/.029 earth wire. (7 strands of 21 B. and S.). In regard to (2) there is no general agreement at the moment, the committee being divided into two schools of thought. One claims that there is useful benefit to be gained from it, the other that it is of very little practical value.

However, it is worthwhile considering item (1) in somewhat greater detail. Note particularly that the earth wire specified is only a fraction of the size used by B.M., which he considers far from adequate anyway. So how do we reconcile these two apparently opposing facts?

WRITE-OFF

It seems to be generally agreed by all those to whom I have spoken that if an aerial is struck by any lightning flash capable of discharging at the rate of 90,000 amps (and no one has questioned this figure), then the aerial would almost certainly be a write-off. In any case, the effective cross section of the thin walled alloy tubing used for aerials and some masts would be much less than that of the 37/.064 used by B.M.

In other words, it is quite unrealistic to attempt to provide an earth wire large enough to carry the largest lightning discharge, if the device we are trying to "earth" is not itself capable of withstanding such a discharge.

However, the presence of an ear connection does ensure a reasonab chance that the discharge will follow th path to earth, rather than find a pat through the receiver and the buildin Even if the earthing system is incapab of handling the current, it will have do its job in guiding the discharge throug the wanted path. Once the discharg has commenced, ionisation will take ov if the conductor fails.

STATIC CHARGES

Another important function of t earth connection is to prevent the buil up of static charges on the aerial whic without any suggestion of the aeri being struck, can assume a potential da gerous to the set or persons using it.

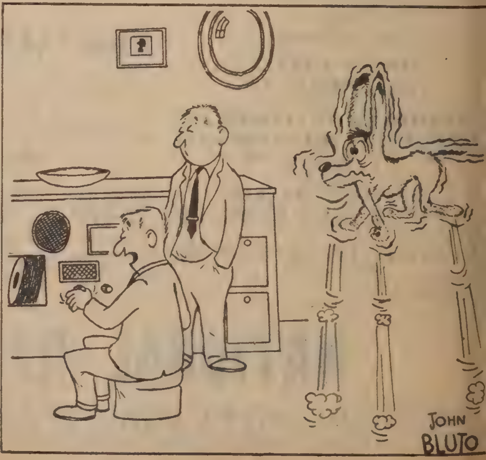
So there it is. If the aerial is goi to be struck it will be struck, most pro ably wrecked, and there is little we c do to prevent it. What we can do, ho ever, is to markedly reduce the risk damage to other objects, including t receiver.

Which brings us, quite naturally, bac to the question of the risk of a TV aeri being struck. I raised this point with bo the aerial firms I mentioned earlier, a received rather surprising answers. Fir No. 1 said that, during the whole peri of TV operation in Australia, they ha not encountered one case when an aeri or tuner had been damaged by a ligh ning strike.

Firm No. 2 had not been so fortunat They had experienced some cases tuner damage, but limited in all cases burnt out aerial coils. And the tot number of cases in five years?

Two!

And on that basis I think it must b



"Of course it is not always fully appreciated that hi-fi equipment can reproduce sounds which are inaudible to the human ear."

MORE LIGHT ON THE LIGHTNING

West Wyalong, N.S.W.

Dear Fellow Sufferer,

Thank you for many interesting articles over many years. Your January article more or less invites comment.

Firstly on the subject of lightning and TV receivers. You must stand condemned for your statement that "perhaps TV antenna masts should be earthed." Remember that your articles are read by other than Sydneyites, and that we bushwhackers have to live with 50 and 60ft masts to get any reception at all.

Of course, these masts must be earthed for lightning!

But what size cable should we use? What current can lightning produce. I have seen a figure quoted of a peak current of 90,000 amps, the whole "strike" occupying one-tenth second.

I have used 37/.064 cable to earth my 55ft mast. This cable would have a rating of 155 amps carrying capacity (in conduit) or 220 amps continuous in air. Used as a fuse it should melt at about 3,500 amps. But will it stand a direct lightning strike? I don't know.

The case you wrote of where the lightning struck the street mains: Only once in my lifetime have I ever seen lightning directly strike aerial mains. And believe me the results from this can be fantastic!

We saw lightning strike 6KV mains and produce a fireball which skated along the aerials for about three miles. It melted the cables at each pole, until it reached the end of the run at a termination consisting of steel brackets of 2½ x 2½ x ½ angle iron on a concrete wall.

Here the fireball exploded like a bomb. The melted angle iron brackets and insulator bits fell to the ground. The stubs of these angle irons in the concrete wall are all that remain. The whole three miles of line had to be recabled. This was in Newcastle about 1944.

I think in your case it is much more likely that the lightning struck the ground near the street mains.

Your question on how many country people still have outside aerials: Many still stick to the big outside aerial tied on to a tree or mast, and it is not a bad idea when the nearest station is 100 miles away even with modern sets (but including battery sets). Often you will see the blade switch type of lightning arrester but I have never seen one which had been moved for years, If they are hit they are just hit and that's that!

I can't agree with you that we should smile and test a valve "for nuttin'" for the customer and hand it back to him after an emission test said "OK." It could have an open screen or gas in it or a dozen intermittents or even be the wrong valve for that position in the set! We should encourage him to bring the set in for his sake and our reputation's sake.

Best wishes,
B.M.

P.S.: Don't take the condemnation too seriously.

greed that the risk of a direct strike nust be very small, indeed. I feel that his is, in large measure, due to the resence of power mains at or about he same height, which seem to take he brunt of these strikes. However, I gree that circumstances would appear to e less favourable in fringe areas where igher masts are used.

Another point B.M. raises, concerns ny suggestion that the damage described n the January issue was due to lightning striking the mains. He questions whether this could happen without doing lot more damage.

This is a tricky one, I feel, because here are so many variables. For one hing, not all lightning discharges produce 90,000 amps. Many could be much ess violent, while still causing moderate mounts of damage. There is also the matter of the "efficiency" of the circuit between the point of strike and the point f damage. What distance is involved, ow many other objects are there across he line, etc.?

OFTEN STRUCK

It seems to be fairly generally agreed hat the power mains are the most frequently struck object in a thunderstorm. Sometimes it does a lot of damage; sometimes it may only wreck a few light lobes, sometimes it may be apparently armless.

It seems likely that B.M. and I will ave to agree to differ on this point, ince I feel reasonably sure in my own mind that the original case involved a ghtning strike on the mains somewhere n the general vicinity.

I was very interested to see B.M.'s omment on country radio aerials, and, n particular, the reference to the lightning arresters that have never been moved or years. It seems to sum up the philosophy of most people on this subject.

Finally, B.M. takes me to task for uggesting (also in the January issue), hat servicemen should test radio valves or nothing, then hand them back to he customer without any further attempt o find out what the real trouble might e.

Did I say that?

I don't think I did, really. Let's take look at what I said in the very last aragraph: ". . . still more important is he contact that testing valves provides ith the customer. If no faulty valves re found, almost invariably we get the ervice job."

CAN'T MISS

I have made this point many times efore, but perhaps I failed to make strongly enough on this occasion. It simply this. It is almost impossible miss out by giving this kind of serce. Either the valves are faulty and e sell new ones, or they aren't faulty nd the customer is left wondering what wrong with his set. (There must be omething wrong or he would not have een prompted to have the valves hecked.)

And while he is in this frame of mind, ven the world's worst salesman should ave no trouble in selling his ervices. After all, the whole thing is rtually being served up to him on a ate!

While it may be freely admitted that valve test is completely infallible, this oesn't weaken the point. On the contrary, it is one good reason to offer the service free, as well as providing a good talking point if all the valves test "Good." ("Of course Mr Jones, we can only test your valves completely in your own set. If you care to let us have a look at it, etc.")

All the foregoing has taken up rather more space than I had intended, but I think the importance of the subject justifies this. And, if I can follow up and report on the findings of the Standards Association, I imagine a lot of readers will also welcome this information.

To conclude the discussion, I would like to thank B.M. for his letter and the opinions he expressed. Perhaps I don't agree with them all, but at least they were thought-provoking. I hope the information I have been able to find and pass on will help him and other readers.

My workshop story this month concerns a rather intriguing fault in a stereo amplifier system. I say "intriguing" because that really is its main—and only—claim to fame. It wasn't a particularly difficult fault, nor anything special in the way of a component defect. It just happened to produce some rather puzzling symptoms by reason of the particular circuit involved.

The customer was a keen audio enthusiast who had, over a period, gathered together a quite impressive array of gear; high quality turntable and stereo pickup, stereo pre-amp and main amplifier, twin speaker systems, etc., all in the classic pattern. And, while he hadn't been foolishly extravagant, he had selected each item with care and spent what he considered to be a reasonable amount. The result was a high order of performance of which he was justly proud.

BALANCE HAYWIRE

That is, until he switched the gear on one evening and realised that the balance between channels—which he had taken considerable trouble to adjust "just so" on the basis of prolonged listening tests—had suddenly gone completely haywire.

Whereas he had previously achieved balance with the control approximately central, it was now necessary to set it well over to one side. And, as he expressed it to me later, "the weak channel didn't seem to be as good as it should be. I couldn't express it in words, but it just didn't seem right."

Fairly obviously the problem called for a preliminary inspection in the customer's home. At this stage the fault

The WARBURTON FRANKI PAGE

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Rotary Selector Switch

0-10-50-250-500-1000 Volts A.C. and D.C.
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ould be anywhere between the pickup nd the speaker systems, and the comete set-up had rather too much spread consider dragging it all down to the okshop without good reason.

Thus I found myself in the customer's unge-room, taking stock of the various nits, and deciding the best point to ben. Mainly because it seemed to be the siest to get at, I settled for the main nplifier. If this section—including the eakers—appeared to be correct, I ould have to turn to the pre-amplifier the pickup.

As it turned out, I was lucky. An ementary sensitivity check—a finger plied to each input channel in turn—owed that the trouble was, in fact, the main amplifier, one channel being arkedly weaker than the other. (While is also included the speaker systems, was prepared to take a chance on these r the moment. While speakers do fail, is was an unlikely kind of fault to find a speaker.)

SEFUL DUPLICATION

One of the advantages of stereo equipent is that, since so many things are uplicated, it is often possible to "swap" spect components or sections for a ick check; valves being particularly ndy in this respect.

In this case I had only a routine idea the circuit, but I knew enough about to make such transposition an easy atter. The first stage was a twin triode, ch half serving one channel. This was llowed by a pair of twin triodes 2AX7's), one in each channel, feeding eir respective push-pull output stages. he 12AX7's functioned as amplifier m phase inverters in the popular "longiled pair" or cathode coupled configurion.

For the simple reason that these two lves represented the easiest swap I uld make I chose them first, and it ok me only a moment to change them er.

I'm afraid the result rather rocked me r a while. For, whereas valve No. 1 channel No. 1 gave weak—though able—results, valve No. 1 in channel o. 2 would not work at all. At first I agined that the valve must have been the point of complete failure before touched it, the movement being suffient to finish the job. However, putting e valves back in their original sockets on scotched that idea; they behaved actly as before.

IME IS VALUABLE

Unfortunately, intriguing and all ough such problems are, one cannot ways afford to follow them to their gical conclusion in the middle of a b. Time is valuable, other jobs are aiting, and, as in this case, the customer ay be waiting for some positive action.

For this reason I decided to assume, least tentatively, that the 12AX7 was ulty and let it go at that. Since I had spare one on hand it was simple ough to confirm the fact anyway, and e customer was obviously more interted in having his precious gear put ck into proper working order than in owing the precise reason why it failed.

And, as I expected, the new 12AX7 red the trouble. Balance was restored, e lost performance on the faulty chanl regained, and both valves behaved entically in either channel. So I took y leave of a happy audio addict, who as already sorting records for his next ession."

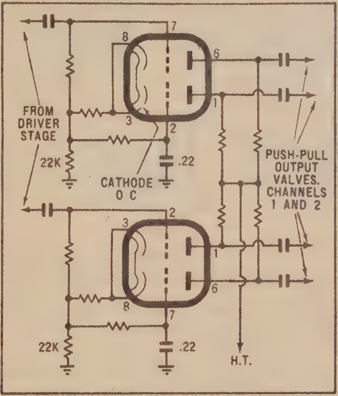
Back at the shop I set out to investigate the rather strange behaviour of the faulty valve. A check in the valve tester confirmed that it was faulty, one section being completely dead, and a visual check showed the reason. The connecting strap from the cathode sleeve to the base pin had broken away at the sleeve, leaving the cathode completely isolated.

HOW IT WORKS

This much established, I tried to visualise how such a valve would behave in a long-tailed pair configuration. And, in order to do so, I found it necessary to recall some forgotten details of how the system worked.

Briefly, it employs one of the two triodes as a more or less conventional amplifier, taking the signal from the previous stage and feeding it to one valve of the push-pull output pair. The second triode is used to drive the other output valve, the heart of the scheme being the manner in which this second triode obtains its drive.

The circuit on this page may help to explain this. While both grids are symmetrical in the DC sense, that of the second triode is effectively at chassis potential as far as audio signals are concerned, due to the heavy by-pass. In addition, both triodes share a common cathode resistor of fairly high value.



Why a faulty 12AX7 produced such strange effects when moved from one channel to another. The two sockets were not identically wired.

If we assume a positive signal on the first triode grid at any instant, then the cathode of that valve also will move in a positive direction. And, since the cathode of the second valve is directly coupled to it, it must do likewise. However, the grid of the second triode is pegged to the chassis, so that the positive cathode swing is equivalent to a negative grid swing, this being the exact opposite of the original signal, and the phase we require for push-pull drive.

However, this is something of an over-simplification. The plate current conditions of the two triodes will be 180 degrees out of phase and these out of phase signals flow through the common cathode resistor. Thus there is a tendency for what happens in the second triode to cancel what happens in the first.

"Tendency" is the operative word here,

(Continued from Page 76)

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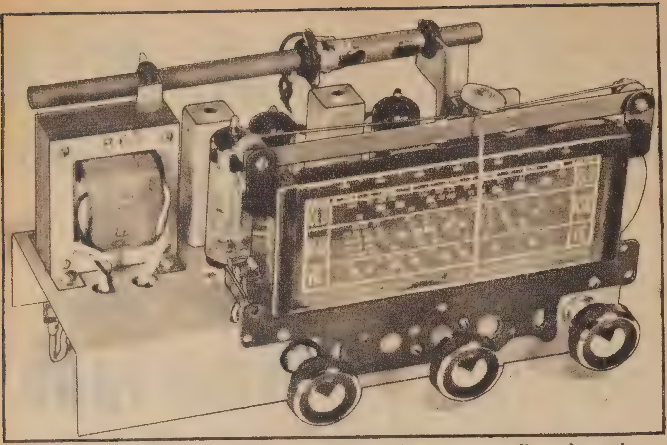


The new components added this month may be seen in a line along the rear edge of the chassis. The dial, tuning capacitor and ferrite rod will be added next month in the final stage.

Little General For 1961—Part Two

Here is our second instalment of the 1961 Little General. In it we discuss the operation of the various transformers, the detector, IF amplifier, and the AVC system. When this much is finished, we will be within striking distance of the complete receiver, which we hope to describe next month.

By Alan Nutt

LAST month we dealt at some length with the operation of the silicon rectifiers and showed how they were used to change an alternating voltage into a direct voltage. No mention was made, however, of the function of the power transformer and we feel that some discussion is warranted before we pass on to this month's circuit.

This is because all the coils in the receiver depend for their operation on the same fundamental principle. Indeed, while we refer to some of the coils simply as "aerial coil" or "oscillator coil" they are, in effect, transformers of a particular type. The coupling coils in the intermediate frequency amplifier are, more correctly, referred to as IF transformers.

MAGNETIC FIELD

A transformer, regardless of its type, depends for its operation on the effect that a changing magnetic field has on a conductor that comes under its influence.

One of the elementary laws of electricity dealing with the operation of motors and generators states that when a conductor is made to pass through a magnetic field, a current is induced, or caused to flow, in that conductor. By the same reasoning, if a moving magnetic field is made to pass through a stationary conductor, the same effect will be observed.

If the polarity of the magnetic field is reversed or the conductor is moved in the other direction, a current will again be induced as before, only this time in the reverse direction.

A power transformer consists of a primary winding and a secondary winding, sharing the same magnetic core. If an alternating current is passed through the primary winding, a magnetic field will be set up in the magnetic core which will vary in intensity as the applied current varies in amplitude from zero to maximum positive, back to zero and then to maximum negative and so on. In other words, the magnetic field intensity at any instant is proportional to the amplitude of the current flowing in the primary.

This magnetic field is a changing field, that is to say, it is varying in intensity at the same rate as the applied current which, in the power transformer in question, is 50 cycles per second. Actually, the magnetic field passes through two points of maximum intensity every cycle, once when the current reache maximum amplitude in the positiv direction and once in the negativ direction. In other words, the magneti field changes its polarity every half cycl or twice every cycle.

The secondary winding, sharing as i does the same core as the primary comes directly under the influence o the alternating magnetic field and w find that in each turn of the winding current is induced. This current i directly proportional to the magneti field intensity and its direction depend on the polarity of the field.

TRANSFERS ENERGY

It follows, therefore, that the curren induced in the secondary winding wi vary in step with the current in th primary winding, the magnetic fiel merely being the medium by whic energy is transferred from one windin to the other. For this reason it can b seen that a transformer, while passin energy from primary to secondary, i no way increases that energy. That i to say, we can get no more power out c the secondary than we put into th primary.

On the other hand, it is possible t effect a voltage increase or decrease b tween the two windings, the governin factor in this case being the turns r lationship between the primary and th secondary. If, for example, the secondary has 10 times as many turns a the primary, then, for a given voltag applied to the primary, we will have 1 times that voltage available at th secondary.

It must be remembered, however, th this is only a voltage step-up and not power step-up. For a given current i the secondary we will need 10 tim that value in the primary. In oth words, the volt-ampere product will b the same in both primary and secondar assuming a perfectly lossless transforme In actual fact, the primary current wi be slightly higher than expected due t iron and copper losses which are u avoidable.

SEVERAL FUNCTIONS

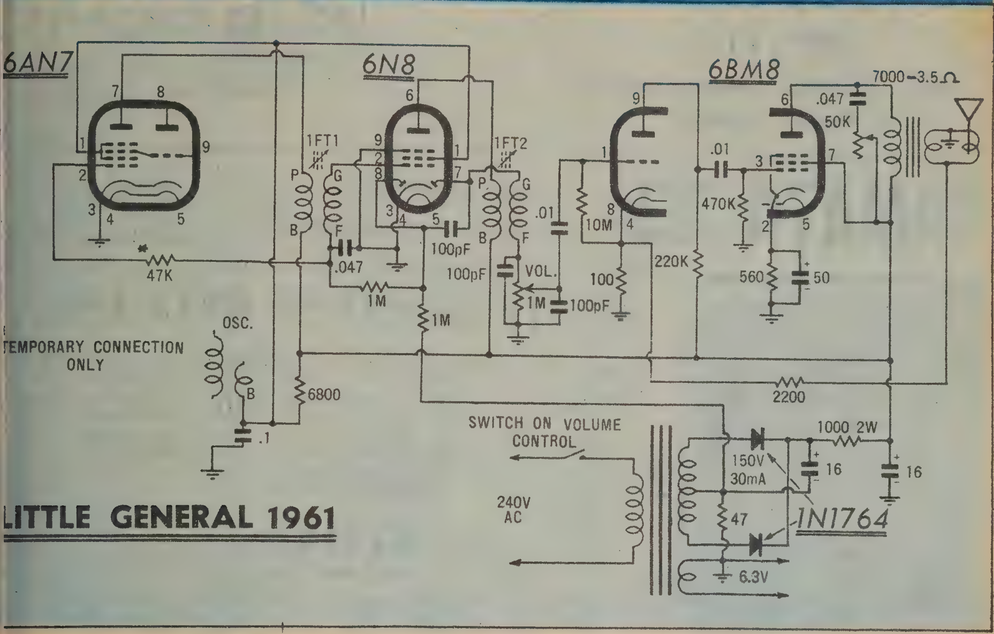
The additions this month consist the detector circuit, automatic volum control (AVC) and intermediate fr quency (IF) amplifier, all these functio being included in the one valve. T converter valve also has been include mainly to help balance the cost over t three stages. It will not be made perform all its functions until ne month, however.

Let us proceed, then, to a consider tion of the various circuit functions i cluded in the receiver this month.

The process of detection is fund mental to any type of radio receive even the simple crystal set relying on t operation of the crystal to perform th necessary function. Indeed, a crystal s contains very little else apart from t detector circuit.

In order that we might understa

MIXER & IF AMPLIFIER ADDED FOR SECOND STAGE



The IF amplifier stage has been completely wired this month, the pentode section of the converter being added in addition. Note carefully the connections to the IF transformers. The 47K resistor in the 6AN7 grid circuit is a temporary connection only.

w the process of detection works, it is cessary to understand, first of all, mething of the action that takes place the radio transmitter.

The transmitter generates a radio fre-ency signal or "carrier" which is of nstant level or amplitude. The carrier elf conveys no intelligence, either ech or music, and is used only as medium for transporting the required elligence from the transmitter to the eiver. Hence its name.

The music or speech is made to "odulate" or vary the carrier level at ate depending upon the frequency of modulating signal. Assuming a tone 1000 cycles per second is used to dulate the amplitude of a carrier, the el of the carrier will change at a rate 1000 cycles per second. From this thod of modulating the carrier comes term "Amplitude Modulation" or t plain "AM."

O SOUND

f this amplitude modulated carrier is lied directly to a loudspeaker or a r of earphones no signals will be rd for the simple reason that the aker or earphones are unable to low the rapid alternations of the car-. On one half-cycle of carrier volt-, the speaker cone will be pushed ward and on the negative half-cycle will be pushed back. However, be-se of the very rapid rate of change ween each half-cycle, the speaker is ble to differentiate between the two acts as if each half-cycle occurred ultaneously.

The net result is no movement at all in the speaker cone and, therefore, no output. However, even assuming that we were able to construct a pair of phones or a speaker that was able to respond to the rapid variations, we would still be unable to hear any sound because the human ear structure itself is unable to follow such rapid variations in intensity.

If we remove one half-cycle of the carrier wave by passing it through a

PARTS LIST

1	Chassis 9½ins x 4ins x 1½ins.
1	Power transformer, 150V a side at 30 mA, 6.3V at 1.8A.
1	Speaker transformer, 7000 ohms to 3.5 ohms.
1	5in elliptical speaker (Rola type F or similar).
1	6BM8.
2	1N1764 silicon diodes.

RESISTORS

(All resistors ½W unless otherwise stated.)

1	10 megohm.
1	470K.
1	220K.
1	2.2K.
1	1K 2W (Or 2 2.2K 1W in par).
1	560 ohm.
1	100 ohm.
1	47 ohm.
1	1 megohm potentiometer with SPST switch.
1	50K potentiometer.

CAPACITORS

1	50 mfd. 12V electrolytic.
2	16 mfd. 350V electrolytic.
1	.047 mfd. 200V paper.
2	.01 mfd. 200V paper.
1	100 pF ceramic.

SUNDRIES

1	9 pin noval valve socket.
1	8 lug tag strip.
2	3 lug tag strips.

Hookup wire, solder, 8 ⅛in nuts and bolts, 3 ⅜in rubber grommets. 1 ¼in rubber grommet. Power flex and plug. Approx. 18ins shielded wire or coax.

EXTRA COMPONENTS FOR PART TWO.

1	B/C oscillator coil. (To suit 6AN7).	miniature
1	No. 1 IF transformer.	
1	No. 2 IF transformer.	
1	6N8.	
1	6AN7.	

RESISTORS

(½W unless otherwise stated).

2	1 megohm.
1	47K.
1	6800 ohm 1W.

CAPACITORS

1	.1 mfd. 200V paper.
1	.047 mfd. 200V paper.
2	100 pF ceramic.

SUNDRIES

2	9-pin sockets.
10	⅛in nuts and bolts.
	Hookup wire, etc.

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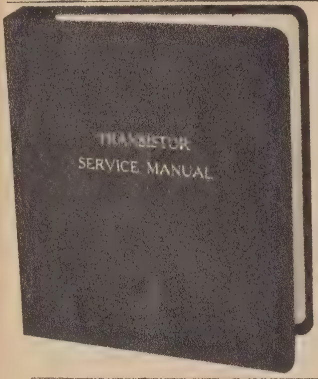

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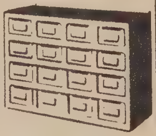

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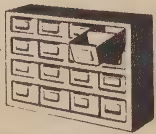

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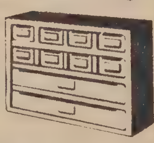

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ctifier, the opposing action on the eaker cone will be eliminated because ch successive half-wave pulse will be the same direction. The speaker will en assume a steady position, the nount of actual movement being de- rmined by the average carrier strength.

We mentioned earlier that the carrier odulation, or intelligence superimposed it, caused the amplitude or strength vary at a rate governed by the fre- iency of the modulating signal. The eaker is quite able to respond to these latively slow changes in carrier ength and will follow them quite ithfully.

This, then, is just what we require in der to be able to recover, or "detect," original signal placed on the carrier the transmitter.

YPES OF DETECTOR

In a practical receiver, the detector ay take one of several forms. The rly crystal set depended on the pro- rty of the galena crystal to carry out detection process. This substance hibits to some degree the same pro- rties as a valve diode in its ability to ss current in one direction and prevent flow in the reverse direction.

More modern semi-conductor devices composed of the elements ger- anium or silicon and are widely used as tectors in present-day practice. The iciency of these recently developed odes is very much higher than the rly galena types, with a consequent im- ovement in overall circuit efficiency. e silicon diodes used in our power pply are an example of this type, hough designed to handle much higher rrents and voltages than would nor- lly be encountered in detector appli- ion.

The valve type diode is still extensively d also and is often included in the ne envelope as another valve, sharing common cathode.

The detection process is accomplished applying the signal across a diode of me type in series with a load resistor, rectified voltage appearing across latter. In its action it is very similar the half-wave rectifier circuit in a wer supply, which we described last nth.

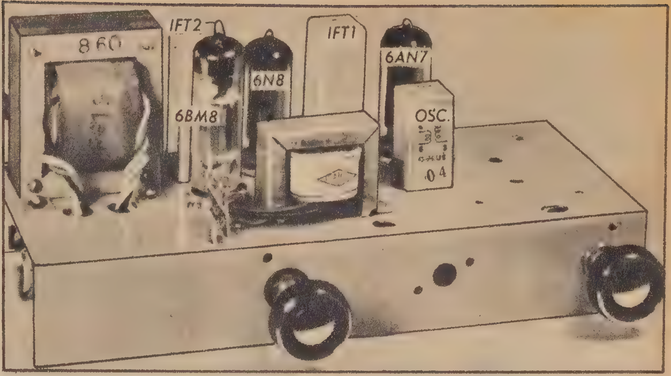
ESULT THE SAME

There are a number of other methods detection apart from passing the sig- through a diode rectifier, leaky grid ector, anode bend detector, etc., but ir end result is the same, namely the aration of the modulation component m the carrier.

Only in elementary sets do we connect earphones directly after the detector. other cases the detected signal is plified before being passed to the dspeaker, the level of the recovered nal being well below that required to rate a loudspeaker. This is the son we have included an audio ampli- section in our receiver.

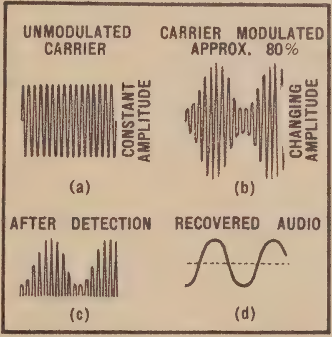
So much then for the detector circuit. pass on now to a consideration of Automatic Volume Control and the thod in which it functions.

n discussing the detector we men- ed that an output voltage could be eloped across the detector load which proportional to carrier strength, ming for the moment an unmodu- d carrier.



The position of the IF transformers, IF amplifier and mixer valves, and oscillator coil can be clearly seen from this photograph. Make no attempt to adjust the slugs in the transformers at this stage in the construction, unless a signal generator is available.

We can apply this voltage as a gain controlling voltage to one or more of the amplifying stages in such a manner that the gain is reduced for strong signals and increased for weak signals. This is useful in a number of ways; it can help to offset signal fading due to atmospheric effects, it can even out the difference in volume between weak and strong stations, and it can protect parts of the set against overload from strong signals.



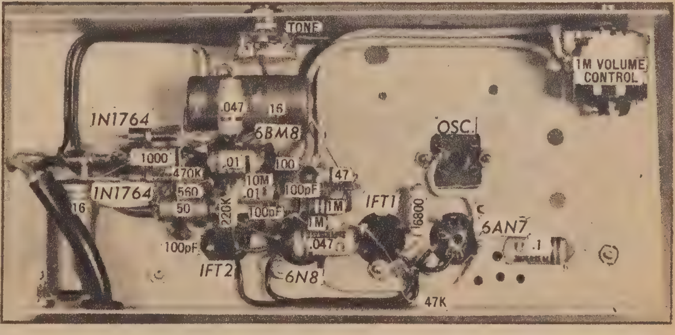
The above diagrams show the various waveforms associated with the detection process.

By passing this control voltage through a filter, we can make it respond only to slow changes in carrier strength such as are caused by fading but not to the rapid changes in strength caused by modulation on the carrier.

More specifically, the AVC voltage is applied to the control grids of the IF amplifier and mixer stages as a variable bias voltage. The higher the bias voltage, the less will be the gain of the amplifier stage and vice versa. When a strong signal is received, the AVC voltage will be proportionally large and the overall gain will be reduced. On weak signals, the AVC voltage will be smaller and the gain will consequently increase. The overall effect is to keep the output from the speaker at a more or less constant level.

I.F. AMPLIFIER

Our next consideration is the intermediate amplifier. There is nothing very special about this stage as far as its amplifying action is concerned, and all we have said regarding the operation of audio amplifier valves is still relevant in regard to the IF amplifier. Its function is simply to amplify the signal from the mixer valve, before applying it to the detector.



This coded photograph should give the beginner an excellent idea of the placement of parts, wiring, etc., and how the set will appear when this stage is completed. It should be compared with the diagram on page 53.

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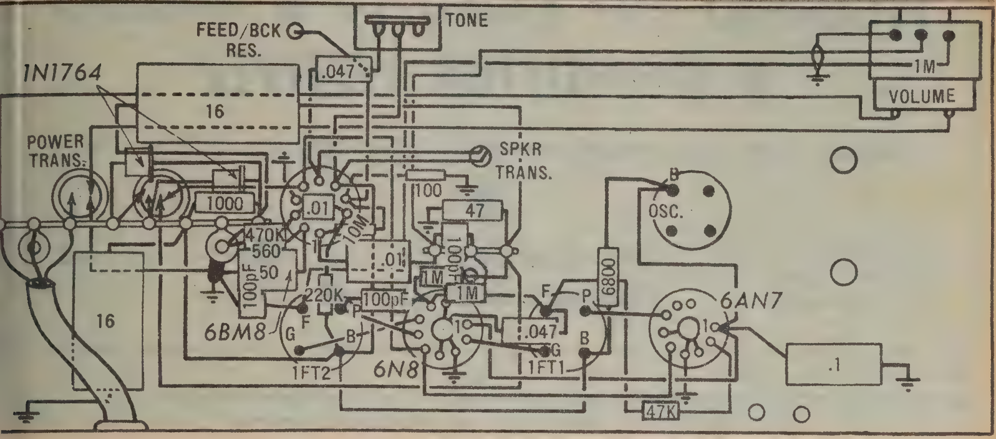
WIRING DIAGRAM SHOWS PLACEMENT OF ALL PARTS



This wiring diagram indicates all the additional components added this month. The wiring to the volume control must be shielded to prevent hum pickup. Compare this drawing with the photograph on page 51.

The reason for using an intermediate nplifier is best understood if we conler the fundamental principle of the perheterodyne receiver and the reason r its development.

Simple receivers such as crystal sets ve an inherent disadvantage in that ey suffer from a lack of sensitivity d selectivity. They require good aerial d earth systems in order to obtain fficient level in the earphones and tions often come crowding in one on p of the other.

AIN, SELECTIVITY

By providing tuned amplifier stages ead of the detector circuit, we can crease the sensitivity of a receiver conlerably and also effect some improvent in the selectivity.

Receivers employing amplification at e signal frequency are referred to as ned Radio Frequency or T.R.F. revers. Although not common these ys, a few are still in use. Their ectivity is still fairly poor, however, r the following reasons.

Tuned circuits do not respond only to nals exactly at the frequency to which y are tuned. A circuit which will pond to signals well removed from e centre or resonant frequency is said be "broad" in its response, while a cuit responding only to signals close the resonant frequency is said to be arp."

For a given set of conditions, the her the frequency of a tuned circuit, broader will be its response. At IF or Very High Frequencies, tuned cuits are used to cover a whole band frequencies without the necessity of uning. Conversely, as the resonant quency of a tuned circuit is lowered, response becomes sharper.

rom this it will be seen that at the v frequency end of the band a T.R.F. eiver will have its maximum selecity or sharpest response. As the set tuned toward the high frequency end the band, so the response becomes ader and the selectivity decreases.

his disadvantage is overcome in the erheterodyne receiver by using a fixed ed, low frequency amplifier to provide constant degree of selectivity. A common figure for broadcast receivers is 455 Kc, and the selectivity provided s quite high.

In receivers designed for the reception of shortwave signals, the selectivity requirements are quite severe due to the large number of stations crowding the bands. In such cases, it is usual to use an intermediate frequency even lower than 455 Kcs and some communications receivers use a frequency of 85 or even 50 Kcs. At these low frequencies, the response can be made extremely sharp indeed.

The incoming signal from the transmitter is converted or heterodyned to intermediate frequency by combining it with the signal from a local oscillator contained in the receiyer. Usually, both the oscillator and the mixer stage are combined in the one valve, although it is possible to have separate valves to perform the two functions. In this case, the 6AN7 will be used as both oscillator and mixer.

If two signals of different frequency are applied to a valve whose characteristics or operating conditions are such that it is non-linear in operation (the output is not a faithful representation of the input), then the resultant output signal will contain not two, but four frequencies. Both the original signals will be present, but, in addition, there will be signals whose frequencies are equal to both the sum and difference of the two original frequencies.

FOUR FREQUENCIES

By using a suitable tuned circuit in the output of this mixer valve, we can select any one of the four frequencies available.

We use this principle in the superhet receiver by adjusting the oscillator frequency so that the difference between it and the signal frequency will be equal to the fixed intermediate frequency. To select the signal frequency, the oscillator tuning is adjusted so that the difference between the two will always be exactly the same, that is, equal to the intermediate frequency.

As a practical example, assuming a standard intermediate frequency of 455 Kcs, to receive a signal on 1000 Kcs the local oscillator frequency must be set to 1455 Kcs so that after the mixing process we can select the difference between the two which will be 455 Kcs. If the desired signal frequency should be 1500 Kcs, the oscillator frequency will be 1955 Kcs, so that the difference will still be 455 Kcs.

The signal frequency tuned circuits and the oscillator tuned circuit are made to vary together by the use of a ganged tuning capacitor, one section tuning the signal circuits and the other the oscillator.

Of course, the foregoing will be more relevant next month, when the oscillator section is included in our set, but even so, we feel that a discussion of the theory involved is warranted at this stage.

I.F. TRANSFORMER

Returning to the circuit, it will be noticed that an intermediate frequency transformer is used to transfer energy from the plate of the 6AN7 to the grid of the 6N8. This transfer is accomplished in exactly the same manner in which the power transformer passes energy from the primary winding to the secondary winding, the only difference being the frequency at which the two transformers operate.

A second IF transformer is employed to couple the signal from the plate of the IF amplifier to the diode plate where detection takes place. The 1 megohm potentiometer is the diode load resistor across which is developed the rectified voltage from the carrier, varying in strength in step with the modulation applied to the carrier. These "audio" variations only are passed on through the .01 coupling capacitor to theg rid of the audio amplifier.

A 100 pF capacitor couples some energy from the second I.F. transformer to a second diode anode which rectifies the signal in exactly the same way as the detector, the AVC voltage being developed across the 1 megohm resistor returning to the centre tap of the transformer. The other 1 meg resistor and the .047 mfd capacitor are the filter components which prevent the AVC voltage following the audio variations in carrier strength.

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The AVC load resistor is returned to e centre tap of the transformer for vo reasons. The 47 ohm resistor be-veen centre tap and earth has a small gative voltage developed across it by ason of the normal HT current drain. 'e use this negative voltage as the itial bias voltage for both the IF nplifier and converter valves, saving mponents in the process, and at the me time providing a small reverse bias the AVC diode.

The purpose of this bias is to delay le action of the AVC voltage which ould otherwise prevent the full gain of ceiver being available for the reception weak signals. The AVC diode will gin to conduct only when the carrier ltage rises above the level of the bias ltage applied to its cathode, no control ltage being available until this occurs.

RID PIN

Coming now to the actual construction, a point to bear in mind is the connection to the control grid, pin 2, the 6AN7. As yet, we have not icluded the ferrite aerial assembly and is through this and the AVC line at a return path is made for the 6AN7 grid. We have made a temporary connection by using what will eventully be the oscillator grid leak as the control grid leak, returning it to the AVC terminal on the first IF transformer so that we can utilise the bias vltage at this point.

The mounting of the coils may pose a problem due to the difference in mounting methods employed by the various manufacturers. We have used I transformers with threaded lugs on th cans so that they could be easily munted with a couple of nuts. Other manufacturers prefer to use tinned lugs so that the can may be soldered directly to a printed board or to a chassis.

It is rather difficult to use this latter tye if an aluminium chassis is employed although by no means impossible. One approach is to drill a small hole in the chassis either side of th can and fasten a small eyelet in each hole. When placed in position the lus on the cans may be bent over and soldered to the eyelets to give a rigid munting.

Methods which permit the can to wbble about should be avoided since an intermittent earth connection to the ca may give rise to instability in the receiver.

COILS AND SOCKETS

Note carefully the orientation of the cols and the valve sockets. This is quite important in this part of the set since it governs the length and placement of crical leads. The arrangement shown is intended to keep these short and properly spaced in the interest of stabli.

f the wiring diagram is followed closely, no trouble should be experienced in this regard. All plate and grid lels should be as short and direct as possible. If any signal at the output of th IF amplifier should find its way bak into the input by stray coupling, th whole stage will function as a very ni tuned plate-tuned grid oscillator. This, however, is a most undesirable codition as far as our receiver is concened.

he 6800 ohm dropping resistor for th IF and converter screens and oscillair plate is mounted between the B plus terminal on the first IF transformer and the B plus terminal on the oscillator coil. The other connections on the oscillator coil need not be wired in until next month. Pins 8 and 9 on the 6AN7 socket are left unconnected at this juncture.

After completing the additional wiring, check carefully for possible errors. At this stage do not attempt to adjust the iron dust slugs in the IF transformers. As supplied from the manufacturer, they will be fairly close to the correct setting and we wish to utilise this fact when we commence the alignment of the finished receiver.

Switch the set on and, after the preliminary warm-up period, touch a screwdriver to the grid pin of the 6AN7. If the set is functioning correctly a loud click will be heard in the loudspeaker. No stations will be evident, however, as, without the oscillator functioning, only signals on 455 Kc will be able to pass through.

Although we will not consider the alignment procedure until next month, it would now be possible to align the IF transformers providing one had access to a signal generator. The generator may be connected from the grid of the 6AN7 to chassis and the IF channel aligned on 455 Kc. However, more of this later.

The audio stage of the receiver may still be used as an amplifier for a pickup although, in theory at least, the additional detector circuit may upset performance somewhat. If pickup operation is to be a permanent feature it would be advisable to fit a small switch which would connect the volume control to either the detector circuit or a pickup terminal as required. We may show how to do this in a later article.

Next month, with the addition of the converter stage and aerial coil we will have completed our receiver and, after alignment, will be able to install it in its cabinet which we also hope to describe in the next issue.

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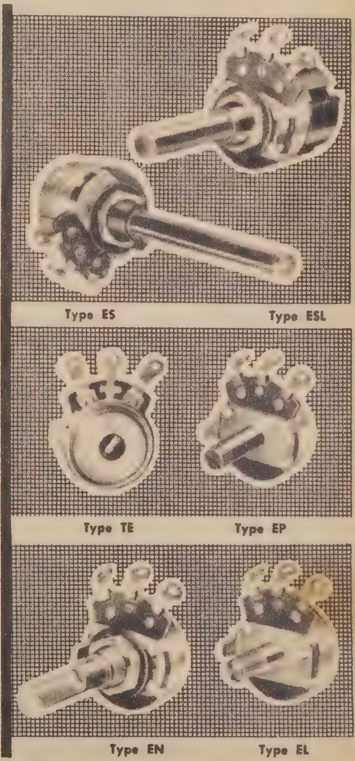

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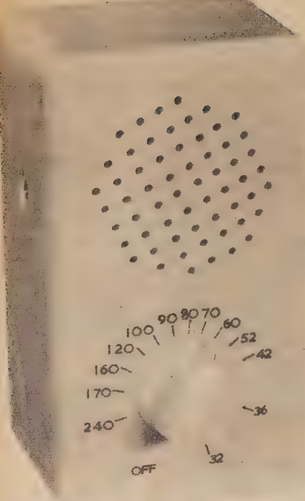
METRONOME USES ONE TRANSISTOR

Here is an electronic version of an instrument familiar to generations of musicians the world over. Using only a single transistor and a handful of components, this electronic metronome is both simple and inexpensive to construct.



The transistorised metronome, housed in its cream plastic case. It has an in-built loudspeaker but can be used with a hearing-aid earpiece.

PERHAPS before proceeding with the details of this transistorised version of the metronome, it may be interesting to diverge a little and to discuss the history, and inner workings, of the mechanical instrument.

Toward the end of the sixteenth century, Galileo established the laws of vibration of pendulums and realised the possibilities of some form of pendulum as a time keeper. He also established the important law that the times of vibration of different simple pendulums are proportional to the square roots of their lengths. After his death a scheme for a pendulum time-marker was discovered among his papers.

A compound pendulum for musical time-marking, created by a man named Winkel, was in existence in Amsterdam in 1815, where it was seen by Johann Maelzel while on a visit to that city.

Maelzel had, for some time, been considering the idea of a chronometer for music and was impressed by the ingenuity of Winkel's instrument. Upon his return to Paris he made a replica of the instrument, adding a scale of divisions and patented the device under the name of metronome.

Winkel brought the case to law and was finally given credit for the invention. However in the interim Maelzel had set up a factory and sold many instruments under his namefi to such an extent that, though the patents must long have lapsed, the apparatus is still known as "Maelzel's Metronome."

The instrument in its familiar pyramidal case, which we know today, is substantially the same as that conceived by Winkel, and manufactured by Maelzel, having remained virtually unchanged for almost 150 years.

It consists of a steel reed pendulum about 7in long, pivoted 1¼in from its lower end, which carries a fixed mass of lead. The pivot and lead mass are contained inside the lower portion of the case, together with the clockwork and escapement by which the pendulum maintained in motion. The escapeme also provides the tick from which c can count the beats of the pendulu

A degree of variation in the timing the beats is achieved by means of adjustable brass weight on the pendulu A scale fixed to the case behind the pe dulum indicates the number of beats each minute for a corresponding setti of the brass weight. The range covered usually from 40 to 200 per minute.

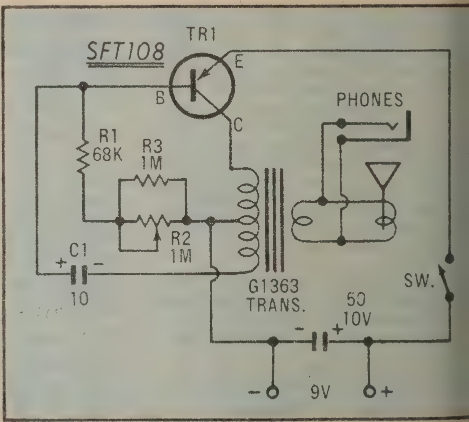
Where a composer has a specific timi at which he desires a particular work be performed he will usually indicate t fact by the letters "M.M." and a numb the M.M. standing for "Maelzel's Met nome" and the number being the beats a minute.

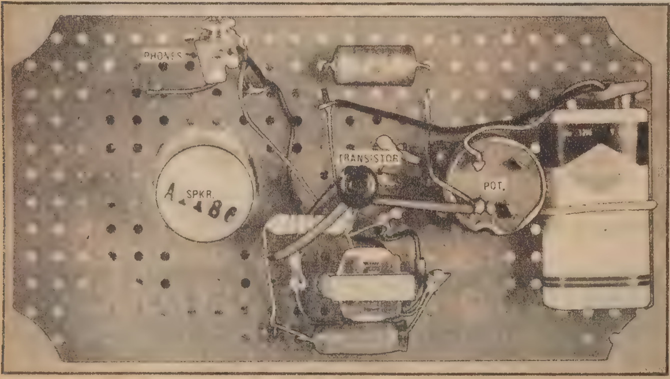
It would be beyond the scope of average home builder to construct mechanical, clockwork type metrono but, fortunately, it is not necessary

Shown on the right is the circuit of the transistorised metronome. As with many little gadgets of this type, a certain amount of experiment may be necessary to get optimum results but it can be made to work extremely well.

☆

The layout is not critical but the suggested assembly on a piece of matrix board is very convenient.





go to that length in order to achieve desired results.

A transistor, when arranged in a su able blocking oscillator circuit, will pr duce a loud, crisp tick, the timing which can be made continuously varial within fixed limits.

Such then is the transistorised met nome which we present this month. T transistor T1 is arranged as a blocki oscillator whose timing is controlled the resistance capacitance network R2 and C1.

A pulse of the correct polarity coupled through the transformer charge the capacitor C1 and bias the tra sistor beyond cut-off. In addition charging the capacitor the transforn also couples the pulse to the loudspeak a 2¼in MSP miniature type A1186.

Discharge of this capacitor takes place through the resistors R1, R2 and R3, an increase in resistance raising the time required to discharge.

The resistance R3 shunted across the rate potentiometer R2 has the effect of reducing its otherwise extremely wide range down to a more usable value, he instrument described being calibrated rom 32 to 240 beats per minute.

It is most important that the capacitor C1 should be free from any form of eakage, otherwise it will not be possible o achieve the desired lower beat limit. n our case it was necessary to parallel wo 5 mfd, 75-volt working, high quality lectrolytic capacitors in order to obtain atisfactory results.

IFFERENT TRANSISTORS

An increase in the upper limit can be btained by reducing the value of R1 or 2 and R3, but this should not be neessary except in extreme cases.

Several different transistors were tried uring construction of the unit, and hile all of them actually worked, the ucon type SFT108 produced the best esults and is, therefore, recommended.

Similarly, a number of transformers ere tried, varying from a standard 50,00 ohm centre tapped speaker transormer, which did work in a fashion, to he 540 ohm, centre-tapped transistor utput type, which was finally used. This designated as MSP type 38158A.

Provision is made to plug a crystal ype earpiece into the unit should this e desired. No attempt at switching the peaker out of circuit while using the eadphone was made, as it was found at the reduced loading on the transormer caused a variation in the speed f the unit.

The unit, as pictured, was constructed n a piece of matrix board measuring in by 3in, and a plastic case measurg 6¼in x 3½in x 2¾in was used to ouse the completed instrument. It is the ame type of case used in previous isues for our little transistor set.

The postions of the various componnts on the matrix board are clearly inicated in the photograph, with the 2½in udspeaker on the left and the 1.0 meg otentiometer and 9 volt battery on the ght. The board is held in position in e case by the potentiometer.

TICK" RATE

After the metronome is wired, the attery should be connected and the unit witched on, when one tick will be heard mmediately. A decrease in the resistance R2 will cause the number of ticks increase.

Before commencing calibration, check e range of ticks to make sure it exeeds 40 to 200 counts per minute. Some djustment of R1, R2 and R3 may be ecessary as described earlier.

Calibration of the metronome is hieved by counting the number of cks over a given period of time and arking off the various positions of the te potentiometer accordingly. For the ower rates better accuracy can be obined if the ticks are counted over seval minutes.

Extremely long battery life can be pected from the unit, due to the low rrent drain, which varies from 200 icroamps, to a maximum of about one illiamp.

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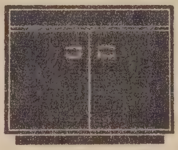

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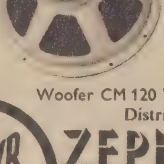

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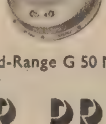

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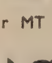

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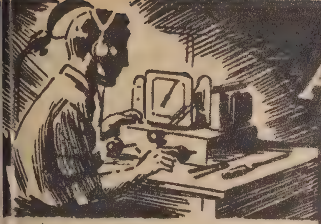
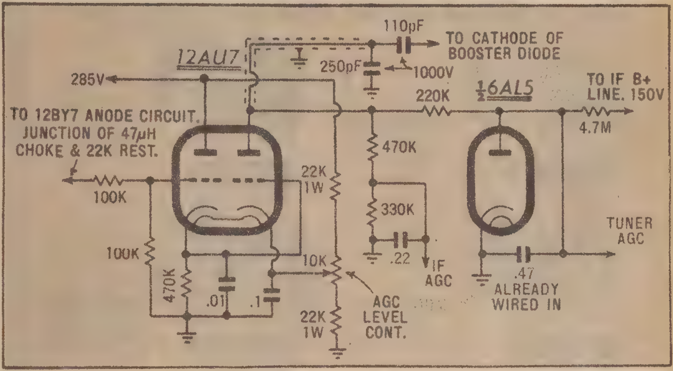


A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

GATED AGC SYSTEM FOR R,TV & H TV RECEIVERS

Mr. B. Cabena, of Eccleston Electronics, 146A Cotham Rd., Kew, Victoria, sends in this circuit and information on a gated AGC system developed for our television receivers. We publish it in its entirety for the benefit of constructors of these receivers.



Mr Cabena writes as follows:—

'The simple AGC at present used in se receivers suffers the disadvantage that the AGC voltage level is also uenced by the picture content of the nsmitted signal, which, of course, has ge amplitude variations.

URING SYNC. PERIOD

'With the gated system the AGC volt- is derived solely during the sync. se period and at a time when the plitude is at a constant level as fixed the transmitting station. Thus, the C bias remains at an average level ich is proportional to the strength of received signal.

'Readers are referred to the article GC Circuits for Television Receivers' page 80 of April, 1959, "R., TV & It was decided to adapt the circuit wn in Fig. 6, the most important dification being the omission of the d-back network C54, 41 and R46.

This means that the sync. pulses are longer cancelled out and therefore reference is at the sync. pulse level not the black level. Under these ditions, the AGC voltage increases than 10 per cent and seeing that sync. pulses are well clipped in this t of the circuit, the chance of 'lock ' occurring is negligible.

If the network mentioned above is omitted, video signals are fed ough it into the sync. stages, causing tic horizontal sync operation and t verticals on the right-hand side of picture.

RATIC OPERATION

The AGC level control (a pre-set pot. unted on rear of chassis) is set for operation of the contrast control. h no signal input, AGC voltage is ut —.5V; with average signal, tuner voltage is —4.4V and IF —3V.

The gain of the system can be demon- ted by disconnecting the antenna. ing about two feet of ribbon at- ed to the receiver (our location 20 es from transmitters). Sync. opera- is perfect and picture good on the three channels but with fairly heavy snow.

"When installing this system in the 1957 TV receiver, two modifications to the existing circuit are necessary. Obviously the first is to disconnect the simple AGC lead at pin 2 on the 12BY7 video amp. then remove the two .01 mfd bypass condensers and the 200k and 100k resistors, also the .5 mfd on the IF AGC line.

"The second is to remove the 12pf capacitor connected between pin 4 on the 6SN7 line osc. and the AGC pulse line, which is taken from the booster diode cathode. If this is left in, line synchronisation will not be obtained.

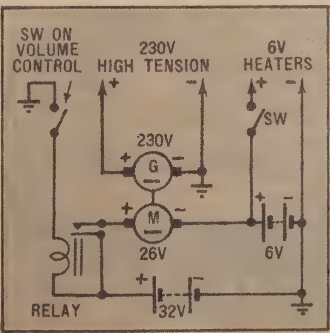
"With the succeeding receivers the AGC pulse line will need to be wired in using co-ax cable (to prevent line pulses being fed into other parts of the set) connected to the booster diode cathode.

"All simple AGC components will, of course, have to be removed, the only exception being the .47 mfd by-pass on the tuner line. The diode clamp will have to be rewired as shown.

"There will be no difficulty in getting the system to work but the associated wiring should be kept away from the sync. separator stages. We have found this circuit to be an exceptional performer and well worth the effort to install."

OPERATING TV FROM 32V SUPPLY

A LETTER to hand recently from Mr David Hutchins, of Lake Manchester, near Ipswich, Queensland, describes how he is obtaining the supply voltages for his television receiver, in a locality where no 240-volt supply is available.



Considering the purchase of a 32-volt operated receiver a little expensive, he obtained a mains operated model and set about to alter the power supply.

The schematic circuit (left) shows the 26-volt genemotor (Bendix type 5016), in series with a 6-volt battery which is connected in reverse polarity and supplied from a 32-volt DC source. This circuit provides "float" charging for the 6-volt battery and ensures a constant voltage supply to the heaters.

Mr Hutchins emphasises that extreme care must be taken to ensure that the leads to this battery are tight, otherwise an open circuit at this point of the circuit could possibly damage the valve heaters due to the genemotor primary current flowing through them.

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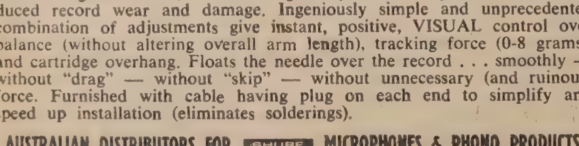

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RADIO GEAR FOR SATELLITES

(Continued from Page 11)

that amazingly few changes had to made—and none amounted to much the way of additional engineering."

The final stages brought a few spi chilling adventures. To make sure t Tiros would survive its launching good working order, NASA request that it be subjected to a force of 30G thirty times the force of gravity.

The R.C.A. engineers scouted throu the north-eastern United States a found laboratories having centrifu large enough to hold a Tiros satell and spin it up to 30G. On two succ sive tries, the satellite was whirled nea up to the required speed when the c trifuge broke.

FLYING WEIGHT

On the first test, a flying weight fr the broken machine crashed through satellite—fortunately without causi major damage. It was repaired in th days of around-the-clock surgery by R.C.A. Tiros team.

"After that, NASA and we both cided that Tiros could stand the fo without proving it on a machine," Go berg recalls.

In a satellite project, the drama d not end with the shipment of the co pleted payload to Cape Canaveral in vibration-proof container. There rem the tasks of wedding it to the rocke the Douglas-built Thor has carried Ti twice into space—and the testing of operating parts during the final cou down.

Tiros II experienced one of the m flawless countdown and launchi sequences on record at the Air Fo launching centre at Cape Canaver With Tiros I, the outcome was triu phant, but the last few hours bef takeoff brought complications that remain forever fresh in the memories those who were there.

SELL IT NOW!

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"Just a few hours before the schedu launch, the electronic clocks inadv ently began to operate," recalls Schna "We tracked down the cause and fou that a passing plane had been transm ting on a frequency very close to command frequency.

"Then, a while later, the second-st guidance system began to act strange This time, it turned out to be a ship the coast operating a radar set on same frequency.

"During the final hour, a lox (liq oxygen) filling valve sprang a leak. Lu ily, it was reachable. Somebody ran to the pad and wrapped a rag arou the leak, soaking it with water to seal leak by freezing.

"The bird got off the ground with o about four minutes to spare before cutoff time for postponing the shot—a the rest is history."

A 450 Kc NARROW BAND FILTER

Last month we considered the degree of selectivity desirable in a modern communication receiver and some of the methods commonly used to obtain it. This month we give you details which will enable you to construct a practical bandpass filter for inclusion in your present receiver.

By Keith Jeffcoat

THE filter is small enough to be fitted in place of a normal 455 Kc IF ansformer, often with little or no modi- cation to the receiver chassis. Its per- rmance is such that it will make ossible true single-sideband reception.

The filter circuit is based on that own in Fig. 4 of last month's article, ith some modifications. The variable andwidth switch has been omitted for e sake of simplicity and an additional ned circuit has been added because of e higher centre frequency used.

A glance at the circuit diagram will ow the configuration used. There are x parallel tuned circuits, the four centre es having twice the capacitance and alf the inductance of the two end nes. One end of each circuit is returned a common ground point and the tops e coupled by means of 10pF capacitors.

DC LOAD

The method used to couple the unit etween the receiver mixer valve and e first IF amplifier is perhaps a little usual. It would have been possible isolate the cold end of the input and tput toroids from ground by means of .01 capacitor and connect one directly the plate lead, the other in the grid ad. However, this would have meant ssing some DC current through the roids, with a resultant loss of Q.

For this reason, an RF choke is used the DC load for the mixer plate and upling to the filter is by means of a 0pF capacitor. In order that this oke should not appreciably load the st tuned circuit, it should have an ductance of at least 10 millihenrys. lternatively, if so desired, a 15K resis- r may be used in lieu of the choke.

While no degradation of performance ould result if the output toroid were serted directly in the grid circuit, echanical construction of the unit pre- nts this so a 220pF capacitor is used to prevent DC coupling to the AVC line.

The filter is designed to have a nominal centre frequency of 450 Kc, though this may vary as much as 10 Kc in either direction, depending on the winding of the toroids and the actual value of their parallel capacitors. In our own case, the centre frequency was 443 Kc, with a possible shift of plus or minus only a few hundred cycles.

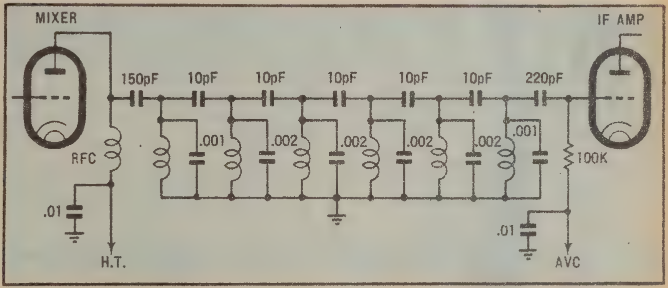
This small centre frequency deviation is a direct result of the large fixed to variable capacitance ratio of the tuned circuits and means that other IF transformers in the receiver will have to be realigned to whatever centre frequency your particular filter should fall on. There should be no hardship here, as most IF transformers are capable of tuning quite a large range, anyway.

Last month, we said that the "shape factor" of a filter was the resultant of dividing the bandwidth at 6 db into the bandwidth at 60 db. Our filter has a bandwidth of 3 Kc at 6 db down and a bandwidth of 10.5 Kc at 60 db down, so it is said to have a shape factor of 3.5 to 1.

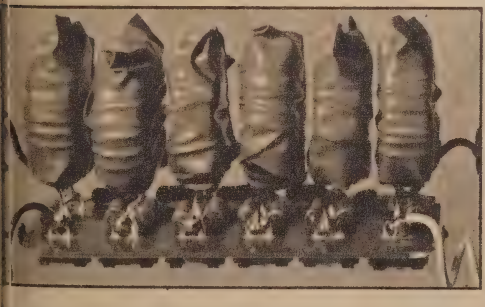
In practice, a more nearly ideal curve could probably be achieved by using a lower centre frequency, say, 85 or 50 Kc, but this would involve us in a number of difficulties, not the least of which is the actual construction of the unit.

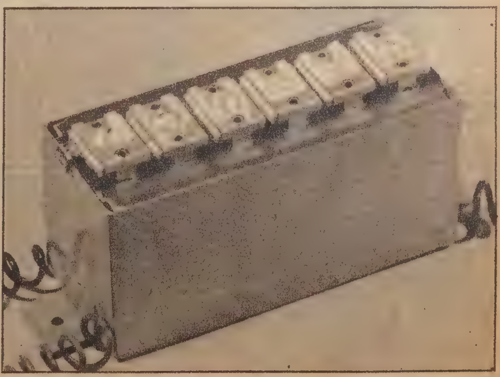
In order to obtain a sufficiently high Q, the tuned circuits are wound on toroids, the end inductors of the filter requiring 31 turns of 20 B and S enamelled wire to resonate at 455 Kc with a 1,000pF capacitor. Imagine how many turns of a much finer wire would be necessary to resonate at 85 Kc. You would require a good deal of skill, plus the patience of a saint.

In addition to this, a filter on 85 Kc would possibly involve an extra frequency change, in order to achieve a reasonable change rejection ratio, with all the complications which this would involve.



Here is the circuit diagram of the filter. The input and output tuned circuits have twice the inductance and half the capacitance of the four centre circuits. Overcoupling is accomplished by means of the 10pF coupling capacitors.





e picture to the right shows the filter complete in a brass case while that above shows the unit removed m the case. The position of the trimmers and fixed acitors can clearly be seen in these photographs.

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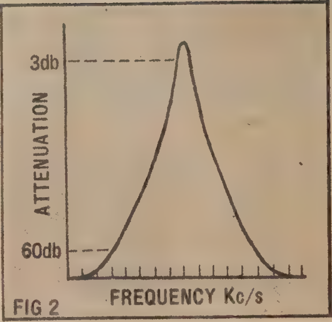

FIG 2

The curve illustrated above shows the response of a typical single 455 Kc IF transformer. It serves to illustrate the relationship between bandwidth and "Q."

One of the prime requirements of any filter aimed at improving selectivity is that it should be placed electrically as close as posible to the input end of the receiver. If the filter is placed at the end of an IF line, unwanted signals will only be amplified to perhaps huge proportions before attempting to eliminate them, a cart-before-the-horse way of doing things.

For these reasons, plus the fact that 450 Kc is the most popular IF in use today, we have designed our unit for this frequency.

Having settled the problem of centre frequency, at least in our own minds, let us look at a few of the factors which influenced the actual design of the unit. One of these, as mentioned earlier, is the Q of the tuned circuits.

The bandwidth of any tuned circuit is directly related to the Q of the circuit, and the following examples will serve to illustrate this point.

Fig. 1 is a test set-up which we can use to measure Q. The formula used with this set-up is:

$$Q = Fc/(F1—F2)$$

The generator frequency reading which gives maximum VTVM reading is recorded as Fc. Detuning the generator on the high side of Fc until a voltage reading, which is .707 of that obtained at Fc is achieved will give us F1. F2 is a frequency on the low side of Fc obtained in the same manner as F1.

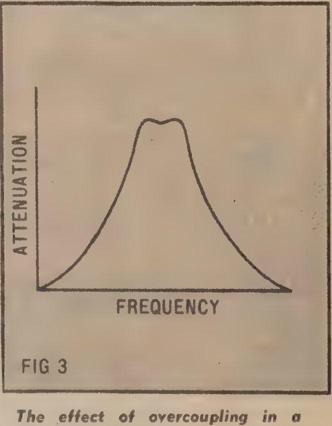

FIG 3

The effect of overcoupling in a standard 455 Kc IF transformer is illustrated above. While there is a pronounced flat-topped effect the shape factor is still poor.

Suppose we have a tuned circuit in which Fc equals 7,000 Kc, F1 equals 7,300 Kc and F2 equals 6,700 Kc. Using the formula given above, we arrive at a Q of 11.666, the bandwidth of this circuit at 3 db down being 600 Kc.

As a further example, let us look at a tuned circuit in which Fc equals 450 Kc, F1 equals 451 Kc and F2 equals 449 Kc. This circuit would have a Q of 225 and a bandpass of 2 Kc at 3 db down.

Reversing this formula, we can find the Q necessary to provide a certain bandwidth at 3 db down by dividing the bandwidth into the centre frequency.

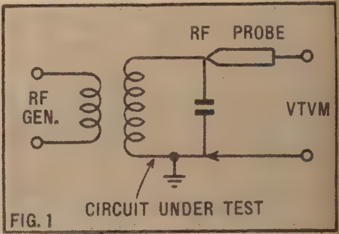

FIG. 1

Here is a simple test set-up which together with the appropriate formula can be used to determine the Q of a tuned circuit.

From these examples, it would at first appear that a single tuned circuit of a sufficiently high Q will provide us with our desired bandwidth. This is true so far as the 3 db point is concerned, but the shape factor of such a circuit would be somewhat like that shown in Fig. 2, still a long way from our ideal.

If we take two such high Q tuned circuits and critically couple them in the manner of a normal IF transformer, the result will be a sharper peak in the response curve with a practically unaltered shape factor.

If, however, we overcouple the circuits, the result will be somewhat like that shown in Fig. 3. Now we have a pronounced flat topped effect, together with a definite improvement in the shape factor.

HIGH "Q"

Our filter is simply a number of such high Q tuned circuits suitably overcoupled in order to give the desired bandpass and shape factor. The insertion loss through the whole network is in the order of 17.5 db.

A rule-of-thumb way to determine the minimum Q necessary to achieve a certain bandpass with a filter such as this is to divide the desired bandpass into the centre frequency and double the result. This means we need a Q of at least 300, where the bandpass is 3 Kc and the centre frequency 450 Kc.

The average 450 Kc IF transformer has a Q of 70 to 150, much too low for our needs. Using the new F4021/Q1 toroid, recently released by Messrs Ducon Ltd., we were able to wind inductances to resonate at 450 Kc which had a Q of 350, with some going as high as 500.

This was achieved by using as heavy a gauge of wire as was practical, together with large value, close tolerance high Q capacitors. Fine tuning of individual sec-

(Continued on Page 67)

SEMICONDUCTORS
INTERCHANGEABILITY LIST

his tabulation lists the type numbers of transistors which are electrically comparable with Ducon types, although not ecessarily physically indentical.

he table is to be used as a selection guide only and published data on the particular type should be consulted for more etailed information. In some instances there are minor differences in characteristics but circuit function would not normally e affected. Care should be taken when making a selection to ascertain if a NPN type is involved; if such is the case a olarity change would be required upon substitution.

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2N28	SFT 152	SFT 153	2N94	SFT 106		2N169	SFT 107	SFT 108
2N34	SFT 152	SFT 153	2N94A	SFT 107		2N169A	SFT 107	SFT 108
2N34A	SFT 152	SFT 153	2N96	SFT 152	SFT 153	2N170	SFT 106	
2N36	SFT 122	SFT 123	2N104	SFT 151	SFT 152	2N172	SFT 108	
2N37	SFT 122	SFT 123	2N105	SFT 151	SFT 152	2N173	SFT 266	
2N38	SFT 152		2N106	SFT 152	SFT 153	2N174	SFT 267	
2N38A	SFT 152	SFT 153	2N107	SFT 151	SFT 152	2N175	SFT 151	SFT 152
2N39	SFT 123	SFT 122	2N108	SFT 152	SFT 153	2N176	SFT 213	
			2N109	SFT 122	SFT 123	2N179	SFT 122	SFT 123
2N40	SFT 123	SFT 122	2N111	SFT 106	SFT 107	2N180	SFT 122	SFT 123
			2N111A	SFT 106	SFT 107	2N181	SFT 122	SFT 123
2N41	SFT 151	SFT 152	2N112	SFT 106	SFT 107	2N185	SFT 122	SFT 123
2N42	SFT 153		2N112A	SFT 106	SFT 107	2N186	SFT 151	SFT 152
2N43	SFT 122		2N113	SFT 107		2N186A	SFT 121	SFT 122
2N43A	SFT 122		2N114	SFT 108		2N187	SFT 151	SFT 152
2N44	SFT 121		2N115	SFT 213		2N187A	SFT 122	SFT 123
2N44A	SFT 121		2N116	SFT 151	SFT 152	2N188	SFT 152	
2N45	SFT 121	SFT 122	2N123	SFT 108		2N188A	SFT 122	SFT 123
2N46	SFT 151	SFT 152	2N128	SFT 316		2N189	SFT 151	
2N47	SFT 151	SFT 152	2N129	SFT 319		2N190	SFT 151	SFT 152
2N48	SFT 151	SFT 152	2N130	SFT 151	SFT 152	2N191	SFT 152	
2N49	SFT 151	SFT 152	2N130A	SFT 151	SFT 152	2N192	SFT 153	
2N54	SFT 152	SFT 153	2N131	SFT 151	SFT 152	2N194	SFT 108	
2N55	SFT 152	SFT 153	2N131A	SFT 151	SFT 152	2N195	SFT 152	SFT 153
2N56	SFT 152	SFT 153	2N132	SFT 121	SFT 122	2N196	SFT 152	SFT 153
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2N59A	SFT 123		2N133	SFT 151	SFT 152	2N198	SFT 152	SFT 153
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2N60A	SFT 123		2N135	SFT 107		2N200	SFT 152	SFT 153
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2N61A	SFT 122		2N137	SFT 108		2N205	SFT 152	SFT 153
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2N65	SFT 122	SFT 123	2N139	SFT 106	SFT 107	2N207B	SFT 153	
2N76	SFT 152	SFT 153	2N140	SFT 108		2N215	SFT 151	SFT 152
2N77	SFT 152		2N145	SFT 106	SFT 107	2N217	SFT 153	SFT 123
2N78	SFT 107		2N146	SFT 106	SFT 107	2N217S	SFT 122	SFT 123
2N79	SFT 152	SFT 153	2N147	SFT 106	SFT 107	2N218	SFT 107	
2N80	SFT 153		2N155	SFT 213		2N219	SFT 108	
2N81	SFT 151	SFT 152	2N156	SFT 213		2N220	SFT 152	
2N82	SFT 151	SFT 152	2N157	SFT 214		2N223	SFT 123	SFT 125
2N85	SFT 152	SFT 153	2N157A	SFT 250		2N224	SFT 123	
2N86	SFT 152	SFT 153	2N158	SFT 214		2N225	2-SFT 123	
2N87	SFT 152	SFT 153	2N166	SFT 106	SFT 107	2N226	SFT 122	
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2N233A	SFT 107		2N350	SFT 213		2N481	SFT 106	SFT 107
2N234	SFT 213		2N351	SFT 213		2N482	SFT 106	SFT 107
2N234A	SFT 213		2N352	SFT 213		2N483	SFT 107	
2N235	SFT 213	SFT 214	2N353	SFT 213		2N484	SFT 107	
2N235A	SFT 213	SFT 214	2N361	SFT 152		2N485	SFT 107	SFT 108
2N236A	SFT 213	SFT 214	2N362	SFT 153		2N486	SFT 108	
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2N252	SFT 108		2N376	SFT 213		2N591	SFT 152	SFT 153
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2N257	SFT 213		2N382	SFT 122	SFT 123	2N613	SFT 121	SFT 122
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2N320	SFT 122		2N447	SFT 108		2N1058	SFT 107	SFT 108
2N321	SFT 123		2N456	SFT 238		2N1059	SFT 122	SFT 123
2N322	SFT 151	SFT 152	2N457	SFT 239		2N1101	SFT 122	
2N323	SFT 152	SFT 153	2N458	SFT 240		2N1102	SFT 122	
2N324	SFT 153		2N460	SFT 121		2N1128	SFT 153	SFT 123
2N325	SFT 213		2N461	SFT 122		2N1129	SFT 123	
2N326	SFT 213		2N464	SFT 121		2N1130	SFT 123	
2N331	SFT 152	SFT 122	2N465	SFT 152		2N1138	SFT 213	

See note following DIODES and RECTIFIERS

Supplies available from your usual supplier. **AGENTS: Victoria and Tasma**

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South Austr

Western Austr

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TRANSISTORS

TYPE NUMBER	COMPARABLE DUCON TYPE
2N1144	SFT 122
2N1145	SFT 122
2NJ5A	SFT 107
2NJ8A	SFT 108
2NJ9A	SFT 122
2NJ9D	SFT 151
2S12	SFT 108
2S13	SFT 107
2S14	SFT 152
2S18	SFT 122
2S24	SFT 151
2S26	SFT 213
2S30	SFT 108
2S31	SFT 107
2S32	SFT 151
2S33	SFT 122
2S34	SFT 152
2S35	SFT 108
2S36	SFT 107
2S37	SFT 122
2S38	SFT 122
2S39	SFT 152
2S40	SFT 122
2S41	SFT 213
2S42	SFT 213
2S44	SFT 151
2S45	SFT 107
2S47	SFT 151
2S49	SFT 107
2S51	SFT 108
2S52	SFT 108
2S53	SFT 107
2S54	SFT 122
2S55	SFT 122
2S56	SFT 122
2S62	SFT 108
2S63	SFT 108
2S91	SFT 122
2S140	SFT 108
2S146	SFT 108
2S148	SFT 107
2S149	SFT 108
2S184	SFT 122
2SA180	SFT 108
2SA181	SFT 107
2SA182	SFT 107
2SB185	SFT 152
2SB187	SFT 123
2T15	SFT 122
2T16	SFT 152
2T64	SFT 152
2T65	SFT 122
2T66	SFT 122
2T73	SFT 107
2T76	SFT 107
2T78	SFT 107
2T85	SFT 122
2T86	SFT 152
2T501	SFT 213
2T512	SFT 108
2T521	SFT 107
2T522	SFT 107
2T523	SFT 107
2T524	SFT 107

TYPE NUMBER	COMPARABLE DUCON TYPE	
CK13	SFT 106	
CK14	SFT 107	
CK17	SFT 108	
CK22	SFT 153	
CK65	SFT 152	
CK66	SFT 153	
CK67	SFT 153	
CK721	SFT 152	SFT 153
CK722	SFT 152	SFT 153
CK723	SFT 151	SFT 152
CK725	SFT 152	SFT 153
CK727	SFT 152	SFT 153
CK751	SFT 122	SFT 123
CK754	SFT 122	SFT 123
CK759	SFT 106	SFT 107
CK760	SFT 106	SFT 107
CK761	SFT 106	SFT 107
CK762	SFT 108	
CK766	SFT 108	
CK766A	SFT 108	
CK872	SFT 153	SFT 122
CK874	SFT 153	SFT 122
CK878	SFT 122	SFT 123
HJ15	SFT 152	
HJ17	SFT 122	
HJ17D	SFT 122	
HJ22	SFT 107	
HJ22D	SFT 107	
HJ23	SFT 108	
HJ23D	SFT 108	
HJ32	SFT 108	
HJ34	SFT 122	
HJ34A	SFT 123	
HJ35	SFT 213	
HJ50	SFT 152	
HJ51	SFT 122	
HJ52	SFT 107	
HJ53	SFT 107	
HJ54	SFT 107	
HJ55	SFT 108	
HJ56	SFT 107	
HJ 57	SFT 108	
HJ58	SFT 108	
HJ60	SFT 108	
HJ62	SFT 107	
HJ63	SFT 108	
HJ70	SFT 108	
MN24	SFT 213	
MN25	SFT 213	
MN26	SFT 213	
OC16	SFT 213	
OC16G	SFT 213	
OC19	SFT 213	
OC26	SFT 213	
OC28	SFT 240	
OC29	SFT 239	
OC30	SFT 213	SFT 130
OC32	SFT 151	SFT 152
OC33	SFT 152	
OC34	SFT 152	SFT 153
OC35	SFT 239	
OC36	SFT 240	
OC41	SFT 108	

TYPE NUMBER	COMPARABLE DUCON TYPE	
OC42	SFT 107	
OC44	SFT 108	
OC45	SFT 107	
OC70	SFT 151	
OC71	SFT 152	SFT 153
OC72	SFT 122	SFT 123
OC73	SFT 152	SFT 153
OC74	SFT 122	SFT 123
	SFT 124	SFT 125
OC75	SFT 153	
OC76	SFT 122	SFT 123
OC77	SFT 142	
OC80	SFT 130	SFT 131
OC110	SFT 151	
OC120	SFT 151	SFT 152
OC130	SFT 151	SFT 152
OC169	SFT 319	
OC170	SFT 317	SFT 320
OC302	SFT 151	
OC303	SFT 151	
OC304	SFT 152	SFT 153
OC307	SFT 122	SFT 123
OC308	SFT 122	SFT 123
OC320	SFT 151	
OC330	SFT 151	
OC340	SFT 152	
OC360	SFT 151	SFT 152
OC601	SFT 151	
OC602	SFT 151	
OC602SP	SFT 122	SFT 123
OC603	SFT 152	SFT 153
OC604	SFT 122	SFT 123
OC604SP	SFT 122	SFT 123
OC612	SFT 106	SFT 107
OC613	SFT 108	
ST5	SFT 213	
ST37D	SFT 108	
ST121	SFT 152	
ST122	SFT 122	
ST163	SFT 107	
ST172	SFT 108	
ST173	SFT 108	
ST301	SFT 152	
ST302	SFT 122	
TS1	SFT 151	
TS2	SFT 152	
TS3	SFT 152	SFT 153
TS13	SFT 152	
TS14	SFT 151	SFT 152
TS15	SFT 151	SFT 152
TS17	SFT 153	
TS32	SFT 124	SFT 125
TS161	SFT 122	SFT 123
TS162	SFT 152	SFT 153
TS163	SFT 152	SFT 153
TS164	SFT 152	SFT 153
TS165	SFT 122	SFT 123
TS166	SFT 151	
TS176	SFT 213	
TS616	SFT 122	SFT 123
TS617	SFT 122	SFT 123
TS618	SFT 122	SFT 123
TS619	SFT 152	SFT 122

See note following DIODES and RECTIFIERS

ucon Condenser Pty. Ltd., 6 Clarice Road, Box Hill South, Vic. (89 0411)

H. Phillips Pty. Ltd., 458 Brunswick Street, Valley, Brisbane, Qld. (LW 2011)

m. T. Matthews Ltd., 95 Grenfell Street, Adelaide, South Aust. (W 7021)

J. McQuillan Pty. Ltd., 7 Queen's Place, Perth, W.A. (21 8911)

ucon (N.Z.) Limited, P.O. Box 2630, Auckland, New Zealand. (5205)

DIODES AND RECTIFIERS

This tabulation lists the type numbers of diodes and rectifiers which are electrically comparable with Ducon types, althou not necessarily physically identical.

The table is to be used as a selection guide only and published data on the particular type should be consulted for mo detailed information. In some instances there are minor differences in characteristics but circuit function would not norma be affected.

TYPE NUMBER	COMPARABLE DUCON TYPE	TYPE NUMBER	COMPARABLE DUCON TYPE	TYPE NUMBER	COMPARABLE DUCON TYPE
1N34	SFD 108	1N112	SFD 108	GEX44	SFD 108
1N34A	SFD 108	1N113	SFD 108	GEX45/1	SFD 108
1N38	SFD 108	1N114	SFD 108	GEX45/2	SFD 108
1N38A/B	SFD 108	1N115	SFD 108	GEX54	SFD 108
1N43	SFD 108	1N116	SFD 108	GEX54/3	SFD 108
1N44	SFD 108	1N117	SFD 108	GEX56	1N191
1N45	SFD 108	1N126	SFD 108	GEX541	SFR 105
1N46	SFD 108	1N127	1N127	OA31	SFR 105
1N47	SFD 108	1N128	SFD 108	OA50	SFD 108
1N48	SFD 108	1N135	SFD 108	OA51	SFD 108
1N50	SFD 108	1N191	1N191	OA52	SFD 108
1N51	SFD 110	1N192	1N192	OA53	SFD 108
1N52	SFD 108	1N198	1N198	OA54	SFD 108
1N54	SFD 108	1N294	SFD 110	OA55	SFD 108
1N54A	SFD 108	1N295	SFD 106	OA56	SFD 108
1N57	SFD 108	1N476	SFD 108	OA57	SFD 108
1N58	SFD 108	1N478	SFD 108	OA58	SFD 108
1N58A	SFD 108	1N480	SFD 109	OA59	SFD 106
1N60	SFD 106	1N541	SFD 110	OA60	SFD 106
1N61	SFD 108	1N542	2-SFD 110	OA61	SFD 108
1N62	SFD 108	1N616	SFD 106	OA70	SFD 106
1N63	SFD 108	1N617	SFD 108	OA71	SFD 108
1N64	SFD 106	1N618	SFD 108	OA73	SFD 106
1N65	SFD 108	1N1169	1N2094	OA79	SFD 110
1N66	SFD 108	1N1763	1N2094	OA81	SFD 108
1N67	SFD 108	1N1764	1N2095	OA85	SFD 108
1N67A	SFD 108	FST 1/4	1N2094	OA86	SFD 109
1N68	SFD 108	GD1E	SFD 108	OA87	1N192
1N68A	SFD 108	GD1Q	SFD 108	OA90	SFD 106
1N69	SFD 108	GD2E	SFD 108	OA91	SFD 108
1N70	SFD 108	GD2Q	SFD 108	OA95	SFD 108
1N75	SFD 108	GD3	SFD 106	OA100/30	SFD 108
1N81	SFD 108	GD3E	SFD 108	OA150	SFD 108
1N86	SFD 108	GD4	SFD 108	OA159	SFD 106
1N87A	SFD 106	GD4E	SFD 108	OA160	SFD 106
1N88	SFD 108	GD5	SFD 110	OA161	SFD 108
1N89	SFD 108	GD6	SFD 106	OA172	SFD 110
1N90	SFD 108	GD8	SFD 108	OA210	1N2094
1N95	SFD 108	GEX34	SFD 106 SFD 110	OA214	1N2096
1N99	SFD 108	GEX35	SFD 106	OAP12	PHG1
1N111	SFD 108	GEX36	SFD 106		

NOTE: During 1961 a new and smaller range of transistors will be released in the TO-1 package. These will be designat by the 300 series. They are considerably smaller than the existing 3A package although electrically equivalent. The inte changeability is as follows:—

SFT 106	SFT 306	SFT 121	SFT 321	SFT 151	SFT 351
SFT 107	SFT 307	SFT 122	SFT 322	SFT 152	SFT 352
SFT 108	SFT 308	SFT 123	SFT 323	SFT 153	SFT 353

For technical literature write direct to: Ducon Condenser Pty. Ltd., Sales Division, P.O. Box 2, Villawood, N.S.W., Austra

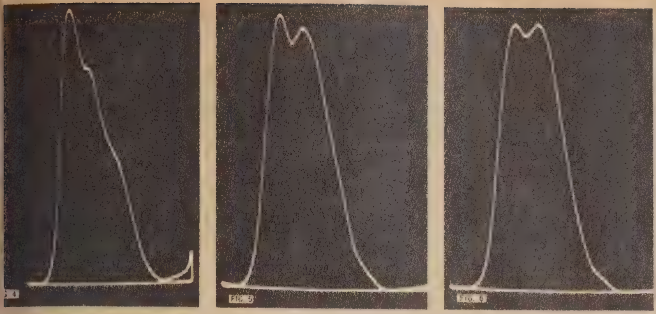

Fig. 4 shows the effect of a normal "peak" alignment of the filter while Figs. 5 and 6 show the result of load aligning together with corrections made by the point by point method.

(Continued from Page 62)

ns is accomplished by means of 20-
0pF ceramic, compression type
immers.

The amount of overcoupling necessary
produce the desired bandpass effect
achieved by means of the 10pF
pacitors used to top couple the in-
vidual circuits.

Coming to the actual construction of
e unit we can commence by winding
e toroids. There are six to be wound
all, the two end ones having 31
ns of 20 B and S enamelled wire and
e four centre ones having 21 turns
the same wire.

n order to prevent the sharp corners
the toroids from scraping the in-
ation off the wire, a layer of plastic
e should first be tightly wound round
ch toroid.

Try to wind the turns as tightly and
evenly as possible, finishing with the
t turn about 3/8 to ½ in, away from
e first. Failure to place the turns
nly may result in one or more
fting position during, or after align-
nt, resulting in a possible misshapen
ndpass.

Remember also that toroids are es-
tially a ceramic material and will
t stand being dropped on hard floors.
is latter warning is inserted because
an unfortunate result in our own
oratory.

A further layer of plastic tape over
completed winding will prevent
fting of turns, in addition to in-
ating the wire from contact with the
ss case in which the filter is housed.
Mounting of the trimmers and fixed

capacitors is accomplished in the following manner: Take a strip of 24 gauge brass measuring 9/32 by 4½ in and solder the earth end of each trimmer to the strip. The spacing between trimmers is 1/16in. Make sure that the end soldered is that electrically in contact with the adjusting screw, otherwise this screw will become "hot" making alignment difficult.

Next cut and drill a piece of 1/16in thick bakelite sheet as shown in the detailed drawing, and pass the two ends of the mounted trimmers, together with the bottom end of the adjusting screws, through the appropriate holes.

Solder a 1,000pF capacitor across the two end trimmers and two 1,000pF capacitors across each of the centre trimmers, keeping the leads as short as possible. Now solder a 10pF capacitor between the unearthed end of each trimmer and its neighbour as indicated in the circuit diagram. The photograph of the completed unit removed from its case shows the placement of these parts.

SHIELD NECESSARY

Cut the leads on each toroid ½in long and solder one across each trimmer, not forgetting to place the two toroids with 31 turns at the input and output ends of the filter.

While a toroid has virtually no external field it is necessary to provide some electrostatic shielding between individual sections and any stray fields which may be present in the receiver. For this reason the unit is housed in a brass case with a six separate shielded compartments, one for each toroid. Complete dimensions are given together with a

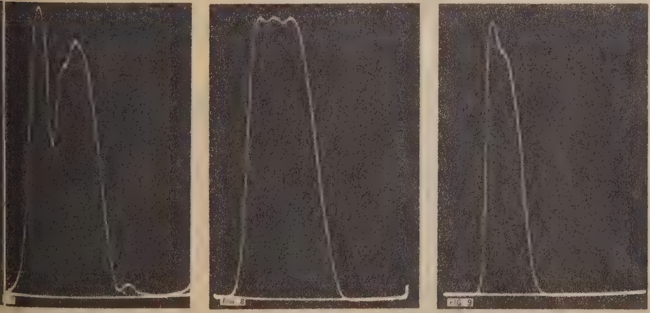

Fig. 7 shows the effect of a single wrong adjustment in the point by point method of alignment. Fig. 8 is the curve obtained by the sweep method of alignment with the correct amount of deviation, while Fig. 9 shows the result of over deviation to the curve of Fig. 8.

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MC82A 13 x 8 x 6 7/8	2	8	0
Al Chassis		19	0
MC87A 15 x 9 x 7	2	10	0
Al Chassis	1	3	6
MC6 6 x 6 x 6		15	0
MC7 10 x 8 x 7	1	2	6
MC67 12 x 7 x 6	1	4	0
MC81 10 x 10 x 8	1	9	0
MC811 12 x 11 x 8	1	19	0
MC79 15 x 9 x 7	2	10	0

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SF7 7 x 6½ x 7¼	1	2	6
SF79 9 x 6½ x 7½	1	7	0
SF71 11 x 6½ x 7½	1	12	6
SF8 13 x 8 x 8	1	19	0
SF10 18 x 10 x 10	2	10	0

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•

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- 1 diamond — 1 sapphire
- 1 diamond
- 1 sapphire

•

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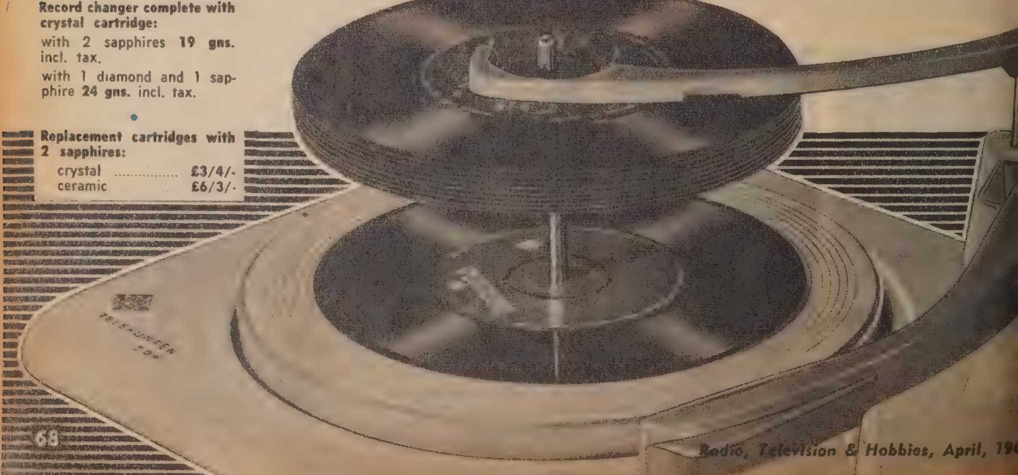
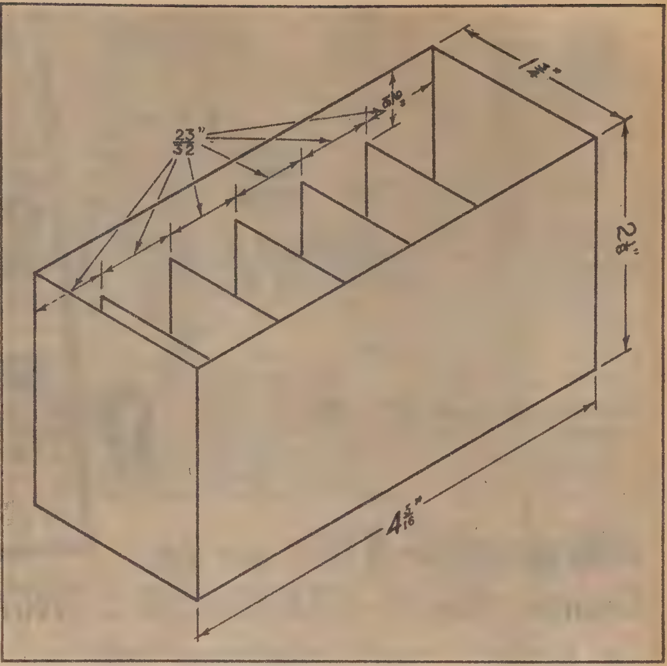
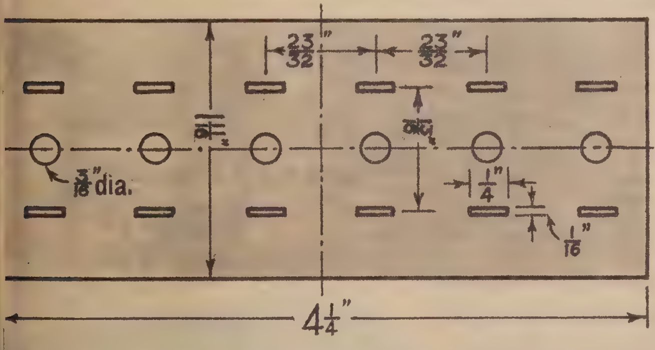




The isometric drawing above shows the dimensions of the brass case in which the filter is housed, together with the placement of the shield partitions.



This is a full scale plan of the trimmer mounting board. It may be placed over the board and used as a guide when marking the holes.

etailed drawing which should make con- ruction easy.

Place the filter carefully in this brass ase and secure in position by soldering ie ends of the brass strip, used as a ɔmmon earth for the trimmers, to each ıd of the case. The unit is now ready) be placed in the receiver and aligned.

You will notice from the photograph ıat our unit has two mounting lugs on s base with the connecting wires rought out the bottom. This method as most convenient for our own use ıt does not have to be rigidly adhered). Almost any method which suits your wn particular application will do, so ɔng as the input and output leads are ept at least 2in apart.

Having placed the filter in circuit, the ext problem is that of alignment. Here ıings may or may not become difficult epending on the amount of time and/ r suitable test equipment which is available.

The normal procedure of feeding a gnal generator into the mixer tube lacing a VTVM probe on the output nd aligning for a peak reading will not ork with this unit. The result would be selectivity curve similiar to the photograph in Fig. 4. You will notice that this much like the selectivity curve for a ngle crystal type filter and far removed om our ideal.

In order to achieve satisfactory reılts two different alignment procedures ın be employed. One is the "point by ɔint" measurement of the filter characteristics after each adjustment, the other the "visual" or sweep method, where ıe whole response is in sight while adıstments are made.

With the point by point system, the ıtput of a signal generator is fed into t: filter (a BC221 would be excellent), ıe AVC line disabled and a VTVM ɔnnected across the diode load resistor. he response amplitude of the filter is ıeasured at several different frequenc s and the results plotted on graph per to provide a picture of the overall sponse. This becomes a lengthy pross if a complete picture is desired.

One method which may be used to t down the time involved in a point t point alignment is to first of all ad align" the filter. In this method a 5K resistor is placed across ıed circuits adjacent to the one being ıed to minimise interaction between t: circuits. Using this method the rve shown in Fig 5 was obtained. slight adjustment of two of the trimmers, with a point by point check between each adjustment, produced the result shown in Fig 6.

While this is not the best response which the filter is capable of, it could be considered as being fairly reasonable. On the other hand a wrong adjustment of a single trimmer produced the curve shown in Fig 7. There are no hard and fast rules with this method; it is simply a matter of trial and error coupled with plenty of patience One good point is that very accurate readings may be obtained once the filter has been correctly aligned.

With the visual method of filter alignment, the output of a suitable sweep generator is fed into the receiver

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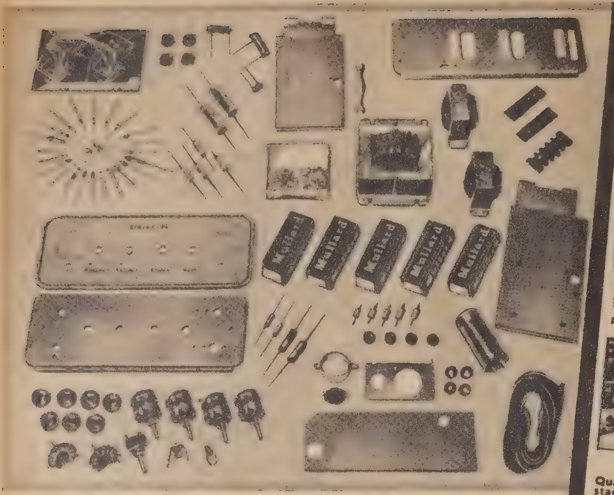

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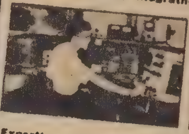

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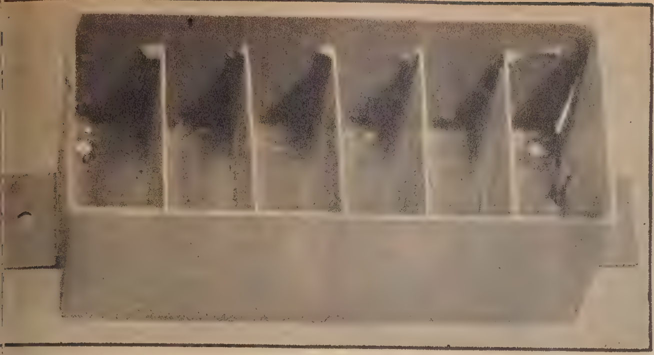

Shown above is the brass case used to house the unit. The two mounting lugs were placed for our own particular convenience and may be positioned elsewhere to suit your own requirements.

d a CRO connected to the second tector. This enables the operator to ew the entire response curve at one ance, so that the effect of any one dividual adjustment may be seen imediately.

Some authorities are adamant in their aims that a true response curve can ly be obtained from a filter such as is if a sweep rate of between 5 and 10 cles is used. Other authorities are ually adamant that a 50 cycle sine ve sweep is adequate for the job.

There is no doubt that the use of e slower sweep rate will considerably duce any possibility of error. owever our own experiments suggest at a sweep rate of 50 cycles is satiactory provided some very definite ecautions are taken.

This does not mean to say that we ve altogether discarded the idea of ing a slower sweep rate. In point of ct such a unit is at present under nstruction in our laboratory and furter conclusions based on the use of s unit may be published in the ture.

In the meantime we have aligned the it using a standard 50 cycles sweep nerator and the resultant displayed rve is shown in Fig. 8. This compared ite closely with a plotted curve obned by the point by point method.

WEEP RATE

When using a standard 50 cycles seep generator, it is important that e deviation control should be set to a ure corresponding with the maximum pected bandwidth of the filter. In s case the filter is expected to be tween 10 and 15 Kc wide at 60 db wn so a maximum deviation of 15 Kc ould be used.

In the event of the sweep rate being high there will not be sufficent e to allow the voltages in the cirit to reach their normal maximum ue. The result will be a distorted resentation of the response being played.

Fig. 9 is a classic example of such tortion. In extreme cases a damped cillation can be produced after the iling edge of the response curve, but, g before this effect becomes apparent, er effects will have produced serious ors.

For those who do not have easy ess to a 455 Kc sweep generator we uld point out that it is quite possible mix the output from a standard signal generator with say the 5.5 Mc from a TV type sweep generator to produce the necessary 455 Kc. This can be accomplished by connecting the output of the two generators in parallel and placing a germanium diode between the parallel connection and the receiver input.

The system was tried in our own laboratory where it produced good results.

It is realised that the possibility of obtaining access to any sort of sweep generator will be beyond the means of a good number of prospective constructors of this unit. To this end we have under construction a simplified 455 Kc sweep generator of low cost which we hope to feature in a future issue.

(We are indebted to Messrs Ducon Condenser Ltd., who supplied the special toroids and trimmers used in the unit and to their technical staff for much of the information necessary to design this filter.)

UNDERSEA CABLES NEW TECHNIQUES

(Continued from Page 7)

Submerged repeaters contain units designed to equalise fixed lengths of cable of the last known characteristics at the time of manufacture of the repeater.

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The new version of our Program Source fits easily into the smaller of the two popular "Unit" type cases. A somewhat shallower type case could be used if available.

Program Source For "Unit" Style Case

Here is an up-to-date version of one of our most popular tuners, The Program Source, originally described in November, 1959. The ready acceptance of a tuner in a case to match the associated gear has encouraged us to produce this new version styled to suit the current trend of "unit" amplifiers. We imagine it will prove extremely popular in the months to come.

By John Davidson

WE should make it quite clear at the outset there are no significant changes in this design from an electrical point of view and, in fact, it would be hard to visualise any worthwhile improvements which would not make the whole design a lot more complex.

On the other hand, readers' comments and suggestions from the trade houses all indicated that there was a need for a restyled Progam Source; one that would match the popular "Unit" range of amplifiers which have become so fashionable in the last 12 months.

SEVERAL PROBLEMS

While, at first glance, it might appear to be a relatively simple matter for the individual to remodel the original layout to suit the new cabinet, those who have tried it have encountered a number of annoying mechanical problems. In short, the original chassis was simply not designed to do the job, and the only solution is to start from scratch and completely reassess the whole problem. This is what we have done.

The result is a chassis which, while providing adequate space for everything without crowding, is a full inch and a half shallower than the smaller of the two "Unit" cabinets. We used such a cabinet for our experimental model and there is no reason why readers should not do the same if they care to, but it is equally possible that a special case may be produced, having the same frontal area and style but taking advantage of the smaller chassis.

The only major circuit alteration is the provision of a preset sensitivity control in the detector load in place of the fixed voltage divider used in previous tuners. This enables simple audio level adjustments to be made to suit individual requirements, depending on whether the control unit or amplifier is a high or low gain type.

The circuit is basically a two-valve superhet tuner, involving frequency converter, IF amplifier and diode detector. Operating under normal conditions, it handles just like the tuner of any household receiver, with good reception on all local stations using a modest aerial. Using a more elaborate aerial, good country and interstate performance is possible under favourable conditions.

However, for purely local listening, there is an added feature. A simple selectivity switch enables the IF response to be expanded, and the high frequency response to be noticeably improved. The switch is a two-pole, two-position type which switches out the second IF transformer and substitutes a resistance—capacitance network in its place.

Reference to the circuit will show th this switching is quite simple, involvi a minimum of critical leads. Swit section Slb is used to short out t secondary winding when in the "wid position, leaving only the diode load circuit. Sla removes the .047 mfd d coupling capacitor from the prima circuit, allowing the 22K resistor assume the role of a plate load.

POWER REQUIREMENTS

The power required for a tuner of th type is something like 200 volts at 15 20 milliamps, plus energy for the heate Most of the Playmaster amplifiers ha been designed for ultimate use with tuner, for which reason a margin h been allowed in the power transform rating. However, where the transform specifications have been varied or whe the margin has not been allowed in t first place, the tuner may require its ow power supply.

The schematic circuit provides f both conditions. If the main amplifi supply can carry this extra load, it simply a matter of running the appr priate supply leads via a 5-pin plug a socket to the tuner. If, on the oth hand, the amplifier supply is inadequa the alternative in-built power supply c be constructed on the tuner chassis seen in the photographs.

Note that, when obtaining the supp from the main amplifier, the hea supply must not be earthed with the tuner. This connection will alrea have been made, and a second one cou cause a short circuit.

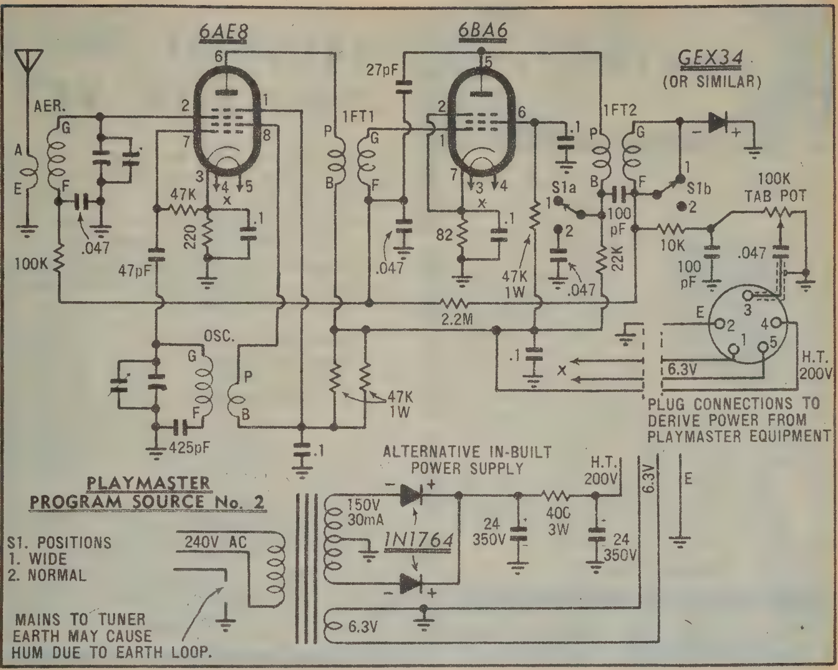
The power supply components a listed separately in the parts list a include a small 150-volt 30-milliar power transformer, two silicon rectifie two electrolytics and a resistor. Althou the circuit specifies silicon rectifiers, equally suitable supply could quite eas be constructed using a rectifier val should one already be available.

A 6X4 would be a typical type a could be used with the 150-volt tra former specified if necessary. Total I would be about 30 volts less than wh using the circuit shown, but should s be adequate in most cases. Alternative a transformer somewhere between 2 and 225 volts could be considered, b care might be necessary to accommod it on the chassis.

CHASSIS DETAILS

Our chassis was constructed fr 18-gauge aluminium and measures 6 x 12in. The rear edge is folded do to give a finished depth of 1⅛in a the front edge is shorter by ⅛in to all clearance for the bottom fold of t front panel. It is attached to the fr panel by four countersunk screws, t heads of which are concealed bene the anodised front plate.

A matter requiring some attention the method of mounting the coils. Sta dard ¾in square holes are provided the chassis, and conventional coil ca may be mounted by drilling holes accommodate the threaded lugs norma fitted. However, many modern coils a now supplied with simrle flat lugs c



The circuit is very similar to our previous version, but note the use of a pre-set gain control. Alternative types of diodes now available are the SFD106 and 1N2095 in place of the GEX34 and 1N1764 respectively. They may be substituted without circuit changes.

PARTS LIST

- 1 chassis 4½in x 12in, 1⅛in. (see text).
- 1 anodised front panel.
- 1 2-gang tuning capacitor. (Roblan or similar).
- 1 MSL/48 dial (to suit gang).
- 1 miniature aerial coil.
- 1 miniature oscillator coil.
- 2 miniature 455 Kc IF coils.
- 1 2-pole 2-position switch.
- 2 trimmer capacitors.
- 1 9-pin miniature socket.
- 1 7-pin miniature socket.
- 1 100 K tab pot.

RESISTORS

- 1 82 ohm ½ watt.
- 1 220 ohm ½ watt.
- 1 10 K ½ watt.
- 1 22 K 1 watt.
- 1 47 K ½ watt.
- 3 47 K 1 watt.
- 1 100 K ½ watt.
- 1 2.2 meg ½ watt.

VALVES

- 1 6AE8.
- 1 6BA6.
- 1 GEX34 germanium diode (or similar).

CAPACITORS

- 3 .1 mfd 400 volt paper.
- 2 .1 mfd 100 volt paper or ceramic.
- 1 .047 mfd 400 volt paper.
- 3 .047 mfd 100 volt paper or ceramic.
- 1 425 pf mica 5p.c. (padder).
- 2 100 pf ceramic.
- 1 47 pf ceramic.
- 1 27 pf ceramic.

SUNDRIES

- 1 5-pin plug and cover, 2 knobs,
- 1 7-lug, 1 4-lug and 1 3-lug tagstrip, length of coaxial cable, hook-up wire, tinned copper wire, 1 dial lamp.
- 2 terminals, solder lugs and solder,
- 1 ⅜in rubber grommet, 6 solder eyelets (see text).

POWER SUPPLY

- 1 transformer, 150V, 30mA, 6.3V.
- 2 silicon diodes, type 1N1764 or similar.
- 2 24 mfd 350 volt electrolytic capacitors.
- 1 400 ohm 3 watt resistor.
- 1 3-lug tagstrip.
- 3 ⅜in rubber grommets.
- 1 length of power flex and 3-pin mains plug.

sned to be bent over and soldered to t underside of the chassis, and these red special consideration.

The most suitable chassis surface r soldering would appear to be t cadmium-plated di-chromate dipped vriety. The only precaution here is t use an iron of adequate size. Next i the plain sprayed steel type, which ny also be soldered, but needs a good cal more attention in regard to cleaning, fx, etc., in order to make a secure job.

Aluminium is least satisfactory, due t the difficulty of soldering to it. While rost builders will use other forms of cassis, an aluminium one can be used i necessary. We overcame the problem t drilling suitable holes on either side o the mounting hole, fitted these with tbular rivets or eyelets, then soldering t mounting lugs to these. These points ny be joined together with bare tinned copper wire and also make convenient earth points.

The dial, type MSL/48, is identical with that used in the Kar Sets and earlier Playmaster tuners. For this application a number of minor alterations are necessary to facilitate mounting, and these are worth considering in some detail.

The first requirement is to invert the entire dial, so that the flange on the back plate mounts directly on the chassis and the pointer mechanism is at the top of the assembly. Naturally the glass will need to be inverted to return it to its original viewing position.

In order to line up the drive spindle with the panel and label, it is necessary to move the drive spindle on the backing plate. It is moved to the extreme edge of the plate, a distance of about 7-16in, and new mounting holes provided. The drive spindle is accommodated in a half-round recess filed in edge of the plate, with two small holes drilled near the edge for the mounting bolts. (See diagram.)

DIAL POSITION

Some care should be taken when marking out the two dial mounting holes on the chassis to ensure that the illuminated station glass lines up correctly with the cutout in the front panel and especially the anodised front plate. This will have a significant effect on the finished appearance.

The dial drum normally comes attached to the back plate by a centre screw. When fitting the drum to the gang spindle, this screw must be removed so that the drum may assume the correct position. A ¼ to ⅜ in. bush will also be required to match the gang spindle to the dial drum. The tuning gang is a midget type, having a maximum capacitance of 415 pf. and is mounted upright by means of the mounting feet supplied.

With this correctly positioned on the chassis, the bush, dial drum, and back plate can be fitted and the dial re-strung in the correct manner. As this is different from the original arrangement, reference should be made to the accompanying diagram for the correct arrangement. The original length of the cord was too short for this job and a new piece may be required.

Reference to the above-chassis photograph on page 75 shows the position of

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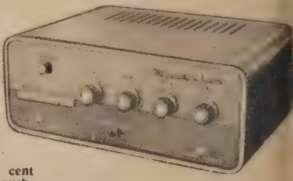

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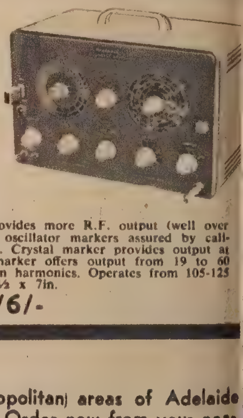

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e tuning gang in relation to the dial d other components.

To the left of the tuning gang is ounted the oscillator and aerial coils. e oscillator coil is towards the front the tuner while the aerial coil is to- rds the rear. To the left of the aerial il is the 6AE8 converter valve, follow- by the first IF transformer. Towards front of the tuner is the 6BA6 IF plifier valve and second IF transform- Partly hidden by this transformer is selector switch and .047 mfd de- upling capacitor associated with this rtion of the circuit.

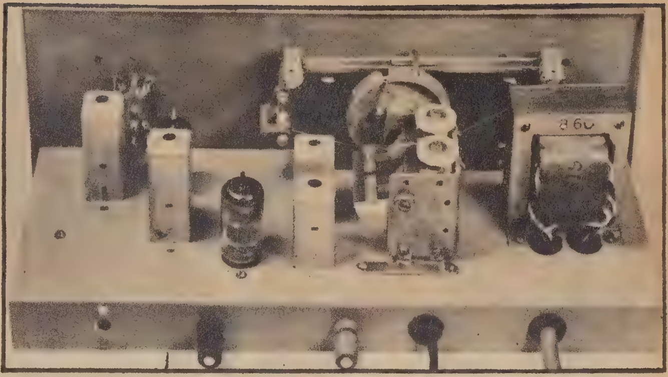
AL LAMP

Although hidden in the photograph, a al lamp is fitted to the dial at the ht hand end behind the power trans- fmer. It lies flat along the chassis close the front panel, the tip of the globe nost touching the edge of the dial ss. It is held by a modified bracket de by removing the 90 degree bend one supplied with the dial.

The under chassis wiring should not sent any difficulty, but we have sup- ed a coded photograph to minimise y problems. Note particularly the entation of the coils, valve sockets ., which is essential in the interests of bility. The "F" and "G" pins of the illator coil and the "A" and "E" pins the aerial coil both lie nearest the tun- capacitor. The converter valve direct- to the right is orientated with the gap the pins towards the bottom of the tograph.

To the right of this socket, pin 6 looks ectly into "P" of the first IF trans- mer. Above this transformer is the amplifier valve socket which also has pin gap towards the bottom. To left is the second IF transformer with s "P" and "B" towards the valve ket. Leads to the selector switch pass ough a hole near this transformer. tab-pot can be seen in the lower t hand corner below the four-pin strip.

Most of the components have been sus- ded point to point, but a 3-lug tag- p (top centre) anchors the two 47K illator HT dropping resistors. Also a g strip on the right of the photo- ph provides an anchoring point in the AGC circuit, detector load circuit, audio output coupling capacitor and coaxial lead to the 5-pin plug.



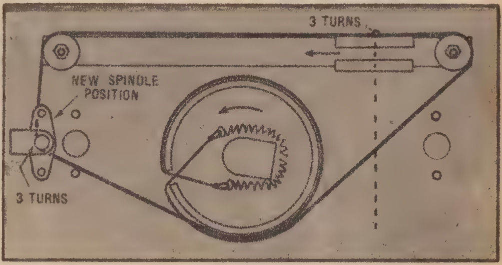
The general layout of the tuner is clearly shown in this rear view. The selectivity switch is partly visible behind the IF transformer on the left. The first IF transformer and IF amplifier are slightly to the right, followed by the 6AE8 converter in the foreground.

The 100 volt paper or ceramic capacitors listed in the parts list should be used as cathode and AGC bypasses while the higher voltage types are used for HT bypassing.

☆

Two dial modifications are shown here. One is the new position for the drive spindle and the other the altered cord path to allow for the inverted mounting.

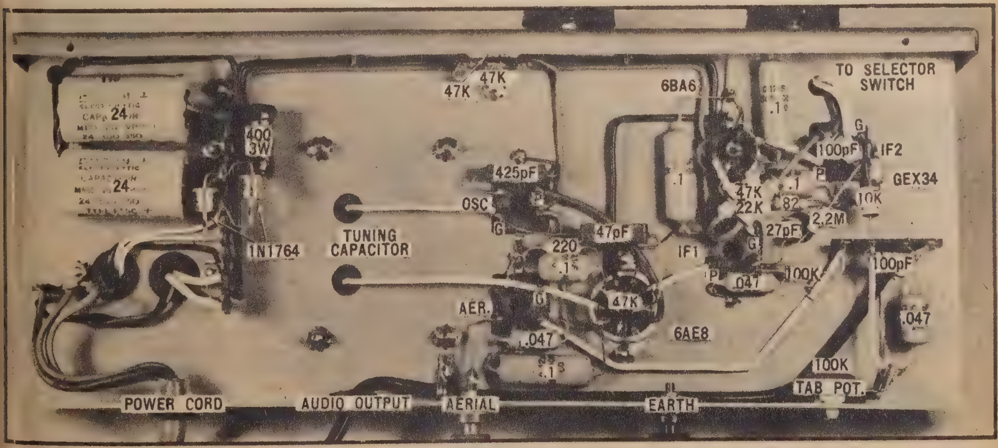
☆



In the original version we used spring loaded terminals for the aerial and earth connections, but these may not always be suitable. If a shallower case should be contemplated these may protrude too far, and a tip jack socket may be a better proposition. The simplest arrangement is probably a short "flying lead," such as used on many commercial sets.

Alignment of the tuner should not present any difficulty as this will be routine to most constructors. We need only remind you that the selector switch should be in the normal position throughout this operation.

When completed, our new Program Source will prove a fitting companion, in both appearance and performance, for your other "Unit" projects.



his coded underchassis picture should assist in correct layout. Note particularly the orientation of the coil cans nd valve sockets. The power supply (extreme left) is optional and only necessary if the associated amplifier is unable to supply the necessary HT current and heater power.

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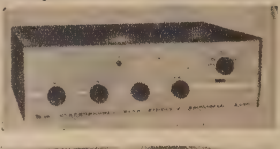

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SERVICEMAN WHO TELLS

(Continued from Page 47)

because, fairly obviously, the signal car never completely cancel itself. If it did there would be nothing to create a cancelling signal in the first place, which i ridiculous. What really happens is tha the system achieves a degree of balance determined by the gain of the valves component values, etc., in which the tw currents nearly, but never quite, equa one another.

TRUE PUSH-PULL?

At this point the purist might b pardoned for complaining that the system is, therefore, not a true push-pul system, because the outputs from th two triodes are not equal. There is simple solution to this problem. All w need do is deliberately unbalance th plate load resistors by the required percentage, thereby varying the voltage developed across them until they ar exactly equal.

There is just one final point. Sinc the signal is applied to the first triod via an unbypassed cathode resistor, ther must be some degeneration due to negative current feedback. However, this i offset in part by the out-of-phase current generated in the second triode; point of some importance in this particular case.

SCHE
THEATRICAL COSTUM

Now, if we assume that the firs triode (pins 6, 7 and 8 in the diagram was intact, and the second one (1, and 3) was faulty, it would provide a explanation of the original fault. Signa would be fed to the upper output valve but the lower one would receive nothing. In addition, the gain of the workin stage would be markedly reduced, due t increased negative current feedback.

On the other hand, failure of the firs triode (6, 7 and 8) would result in n signal to either output valve, since bot the upper output valve and the secon triode would be deprived of signal Something like this had happened whe I swapped the two valves in thei sockets.

At this point the solution becam obvious. It seemed most likely (and was able to confirm this later) that, i the interests of symmetry, the tw 12AX7 sockets were wired in the opposite sense. Thus, while pins 1, 2 and represented the "second" triode in channel one, they represented the "first" i channel 2. Thus the faulty section wa being asked to do two quite differen jobs when moved from one socket t the other.

So there it is; simple when you kno the answer, but quite a puzzler whe first encountered.

A NEW ERA IN COMMUNICATIONS

Recent work involving the much talked-of Laser has bridged the huge gap between the radio spectrum and the frequencies corresponding to visible light. It promises to usher in a complete new era in point-to-point communication. But what is the laser? What is so strange about the light energy which it produces?

AS we pointed out in a recent issue, "talking light beams" are not in any ense a new idea. They have been a aboratory toy for years; they were used n the last war and have undergone teady development since, as a conveni-nt means of point-to-point communica-on.

But the laser is far more than just a urther refinement to an old idea. It a complete breakthrough, as funda-ental, in the words of one writer, as the ep which De Forest took when he put grid in the diode vacuum tube.

REAL BREAKTHROUGH

In two brief stanzas, the breakthrough as been summed up this way: For the rst time in history, the laser makes ossible:—

True amplification of light energy.

The generation of light waves having single frequency, just like the single equency output of a tuned but (as yet) nmodulated radio transmitter.

Scientists describe these unique, single-equency oscillations in the light spec-um as being "coherent."

Most radio enthusiasts are well aware what can be accomplished when a ure or "coherent" radio carrier is modulated in any one of the several ways hich have been devised. And you can ve modulated carriers conducted ong wires or broadcast in all directions, beamed in relatively narrow arcs.

Most enthusiasts know, too, that the igher the frequency of the carrier, the ore complex can the information be, hich it will carry. And the frequencies involved in the light spectrum are far beyond the highest "radio" frequencies hich scientists have ever generated with their most cunningly devised valves and transistors.

This being so, a "radio" style transmission involving a coherent light carrier could carry not just one or two, but literally thousands of complete television transmissions—all on one channel. The number of voice and other communication channels, which could be loaded on to it, would be virtually limitless.

But the story doesn't end there.

The extremely narrow beams which are possible with laser-generated coherent light would allow numerous channels to operate simultaneously, without mutual interference. And the same powerful, narrow beams would make possible a super-precise radar system.

MORE ACCURATE

peaking of precision, it should be possible to harness the "pure" atomic radiation to produce a clock, one thousand times more accurate than the best present-day atom clock, which is already accurate to one second in a hundred years.

ast but not least, scientists see in the new technique the possibility of concentrating thousands of watts of heat energy into a volume the size of a pinhead.

But what is the laser?

For all its revolutionary properties, it actually stems from another development several years old. It may be described as a maser capable of operating at frequencies within the visible light range.

Hence the similarity in the names. One is derived from the other.

Several years ago, Dr Charles Townes of Columbia University—inventor of the maser—suggested that there seemed to be no special reason why his device could not operate in the visible light spectrum.

During the intervening years, theoretical work by both the Hughes Research Laboratories and Bell Telephones in solid state electronics have proved that he was right.

In spite of its tremendous promise, the laser is an extremely simple-looking device. It is nothing more than a cylinder of synthetic ruby about ¼in in diameter and 1½in long, mounted in the centre of a spiral coil of glass.

XENON-FILLED TUBE

The coil is a xenon-filled flash tube, very much like the ones used by photographers for taking flash pictures.

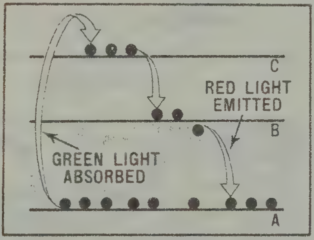
To operate the gadget, scientists send a jolt of current through the gas-filled tube, setting off a brilliant flash of greenish light. The electrons in the ruby absorb this light, and generate energy at another frequency.

To put it another way, the ruby absorbs greenish light, only to give off a pure red ray. And the beam produced

HOW THE LASER WORKS

A laser is a small rod of synthetic ruby which absorbs light energy at one frequency and emits light at another frequency or colour. Its operation depends on the fact that the ruby contains chromium atoms which can be at any one of at least three different energy levels, as illustrated.

The lowest level—A—represents the area where the atoms will normally be. If, however, a photon of light from outside the system hits one of the chromium atoms, that atom absorbs light energy and is lifted to a more excited state, represented by level C.



Almost immediately, it falls back to level B, giving up a little of the energy absorbed from the photon. It remains at level B for a relatively long period, as measured in atomic time — perhaps much as ten microseconds.

Eventually, it falls back to level A, and in the process gives up the rest of the energy absorbed from the photon. This emitted energy is in the form of red light.

The process described so far is normal fluorescence—just like that which takes place in fluorescent lighting. In the fluorescent bulb, ultraviolet light is used to excite the atoms of fluorescent material, which then give off a white light. But the separate quantities of light given off by the electrons are not in phase. Instead, they are random, or—to use the scientists' word—incoherent; in a way, they are similar to radio noise.

The laser, on the other hand, generates a coherent signal—a signal of one frequency, with all electromagnetic light radiation in phase.

An intense green light is beamed at the ruby. This light "pumps" huge quantities of chromium atoms into energy level C. These atoms quickly fall to level B, where they remain for a while. Occasionally, one atom spontaneously falls back to energy level A, emitting red light.

But there are so many atoms now at energy level B that the spontaneously emitted light from the atom that falls will almost certainly bump ino another chromium atom at Level B. This collision will cause the second atom to give off its energy in phase with the first atom. The energy from the second atom bumps into another atom, and so on.

The chain reaction builds rapidly. Because the ends of the rod are silvered, the emitted light bounces back and forth, stimulating still more atoms to give up their energy. Soon, tremendous quantities of red light are rushing back and forth in the rod, like water sloshing back and forth in a bathtub.

Finally, it reaches such a level of intensity that it bursts through one end of the rod (one end has less silver than the other) and shines forth in a brilliant, coherent ray.

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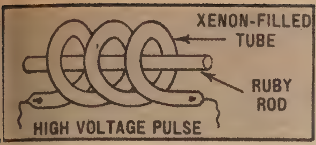
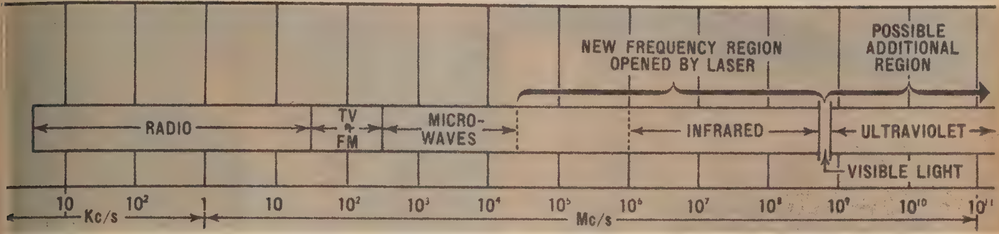


Heart of the laser is silver-ended ruby rod, placed in coiled, xenon-filled tube.



Frequency spectrum, showing the new frequency region opened by the laser. Note laser's wide operating range.

y this atomic flashlight is capable of erforming the feats mentioned earlier—s well as a number of others—because is unique in several important ways. et's see just what makes the laser's ght so different.

"Coherent" Light. The light generated y the laser is coherent. This means that l its rays are at one frequency.

Natural light, in contrast, whether prouced by the sun, a light bulb, or a atch, is made up of rays of many difrent colours, or frequencies. Even ght sent through a coloured filter conins many frequencies, although far wer than "white" light.

ADIO "NOISE"

Light containing many frequencies is ughly comparable to a completely unned radio signal or a raucous noise. ch a hodgepodge signal is impossible control effectively.

About the only thing you can do to tnsmit information with such an unciplined mixture — whether light, rdio frequencies or just plain noise—is t turn it on and off to form a simple cde. Ships, of course, have been using tnker lights for years.

With the laser, we have a coherent lht source for the first time. We can cntrol it in the same sophisticated ways v take for granted in radio.

In addition, because of the extremely hh frequencies at which light is transntted, we can perform a number of tcks impossible with radio.

For example, fantastic amounts of infmation can be packed into one light bm.

With such a system, we may some d transmit thousands of television signls and hundreds of thousands of telepone, teletype, and telegraph signals on a ingle laser beam.

n addition, the laser, by operating in th visible light spectrum, vastly increases the number of useful frequencies we c put to work.

leretofore, we have been able to use frquencies up to about 50,000 mc.

lut even though this upper limit has ben gradually pushed back, the need fc additional space to accommodate the evr-growing load of world-wide communications has grown much faster.

low the laser, in one jump, has extened the range of useful frequencies tremendously. As Dr Theodore H. Maiman of Hughes Aircraft put it recently, "The laser jumps the gap from 50,000 million cycles to 500,000 billion cycles, opening the way for a host of important applications."

Narrow Beam. The coherence of laser light is responsible for another useful property: it makes the laser beam far narrower than any previously available.

For example, a high-quality military searchlight—the kind used to spot raiding aircraft during World War II—produces a beam approximately one degree in width.

One mile from the light, the beam is about 85 feet wide.

This may sound impressive, but only until we compare it with the laser beam —which will ultimately be able to illuminate a spot approximately 5 inches in diametre a mile away.

Another comparison: The beam from the military searchlight, if directed at the moon, would spread to cover an area 3,600 miles in diameter, bigger than the moon itself.

But the laser beam would illuminate a spot on the moon's surface less than 10 miles in diameter, without any optical help at all.

One scientist predicts that with a proper setup of lenses, the diameter of the spot could be reduced to two miles.

THIRTEEN TELEVISION CHANNELS

As a result of investigation by the Radio Frequency Review Committee, the Postmaster General, Mr C. W. Davidson, has announced the provision of 13 channels for VHF television. By industry agreement numbers have been allocated to the channels which avoid the necessity for changing numbers which have become identified with stations already operating in capital cities.

The new arrangement of channels is as follows:

CHANNEL NUMBER	FREQUENCY BAND
0	45- 52 Mc/s.
1	56- 63 Mc/s.
2	63- 70 Mc/s.
3	85- 92 Mc/s.
4	94-101 Mc/s.
5	101-108 Mc/s.
5A	137-144 Mc/s.
6	174-181 Mc/s.
7	181-188 Mc/s.
8	188-195 Mc/s.
9	195-202 Mc/s.
10	208-215 Mc/s.
11	215-222 Mc/s.

Piping it Through. Of course, like every device, the laser has its limitations. Even the higher microwave frequencies now in use are partially blocked by clouds, dust, fog, and atmospheric moisture.

Laser beams, at still higher frequencies, are affected even more. As a result, a point-to-point laser communications link would be put out of commission by fog, or perhaps even by rain.

But there are ways of getting around this problem. Bell scientists have already demonstrated that laser beams, like microwaves, can be transmitted through hollow pipes or "waveguides."

Thus, communications engineers may simply lay waveguides from city to city and literally pipe through huge amounts of information, regardless of weather or other conditions.

What Lies Ahead? As is the case with most new developments, no one knows for sure in just how many ways the laser will turn out to be useful.

Dr Townes predicts that it will push back the frontiers of spectroscopy, revealing further secrets about the basic nature of matter. Distances will be measured with far greater precision than ever before, using Doppler-type radar.

And there will undoubtedly be many other as yet undreamed-of applications for this newest wonder child in the field of electronics.

When will the laser actually go to work? Although it is still in the experimental stage, it should soon be earning its keep.

Out at Hughes Aircraft, Dr Maiman is investigating laser radar. Because of the extremely narrow width of the laser beam, such a radar would be able to pinpoint the location of a distant target to within a few feet, far more accurately than present-day equipment.

POSSIBLE IMPACT?

How great an impact is the laser likely to have on the field of communications? Right now, it's anybody's guess. But those in the field make no secret about the fact that they are tremendously enthusiastic about this new gadget.

With usable frequencies already badly overcrowded in many regions of the present radio spectrum, any system that promises to open up vast new chunks of space is something to get excited about.

Perhaps the potential role of the laser in communications is best illustrated with a remark made by Dr R. J. Collins of Bell Labs' laser development team. Said Dr Collins, "We're not ready to start replacing telephone lines yet. But," he added "we're beginning to think about it." (From an article by Ken Gilmore in "Popular Electronics").

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Let's Buy An Argument

I think I've commented on this before but there is one very discomforting aspect of publishing a technical magazine. One must be prepared for any statement to be "discovered" and held up for examination, irrespective of how long ago it was made. As you might guess, this remark is prompted by a particular piece of correspondence.

By Neville Williams

ACTUALLY, the correspondent in question (B.M, of West Wyalong, N.W.), raised the point in the nicest sible manner. He expressed his gratiu for all the interesting material wich had been published in our magazi over the years and went on to say h he had only ever come across one lenite error—a reference in "Answer To," in column 1, page 53 of the ember, 1957, issue.

'e would be very happy indeed if we cod believe that the incidence of error wa, in fact, as low as that. In fact, we wld be happy enough if it turned out v the years to be no higher than one iscovered error per reader, if you know wt I mean.

OILY HUMAN

ut no, we make our share of misaks, like every other human venture, an we weep tears of blood when they par in cold, hard print, despite all ou efforts to eliminate them.

this case, the paragraph in quesp appeared in answer to Tom's quesp "What is a rotary converter?"

We answered as follows:

"A rotary converter, Tom, is virtually a single-unit motor generator used for converting AC to DC and vice versa.

"The DC section has a regular commutator, while the AC section has slip rings for connection to the armature.

"When converting from DC to AC, rotation of the armature and output from the slip ring gives the AC. The other way round, the action of the commutator gives the rectification effect.

"It is only a matter of design to give any required relationship between the input and output voltage, while the size of the machine largely determines how much power it can handle."

It was this last paragraph, in particular, to which our correspondent took objection.

Summing up the situation, he says there are three basic machines for converting AC to DC or vice versa. Listed in order, these are as follow:

(1) MOTOR GENERATOR. The two sections are electrically independent, the shaft transmitting all the power from one unit to the other. If a synchronous motor, the unit runs at synchronous speed. Input and output voltage can be designed for any combination.

Elaborating on this by means of diagrams B.M. illustrates the motor generator in three forms:

(a) Synchronous motor drive; AC to the input stator, a DC rotor inside the stator, DC output poles, a supplementary DC exciter and DC output taken from the output commutator.

INVERTED MOTOR

(b) Inverted synchronous motor drive, generally similar to the above but with the AC input fed to the AC rotor.

(c) Motor generator using a common iron core but electrically separate windings. This is known alternatively as a Dynamotor or Genemotor but is not a Rotary Converter.

(2) ROTARY CONVERTER. This consists of an armature and commutator and shunt or series compound DC field system, as for a DC generator, together with slip rings on the shaft connected directly into the armature windings. The machine can be driven by AC applied to the slip rings or DC applied to the commutator. All input power is conveyed to the output circuit via the armature windings, the shaft conveying no power load as such.

Since common windings are used, there is a fixed relationship between the AC and DC voltages, which is dependent on the number of AC phases provided for. Thus, for 1 volt DC at the brushes of the commutator, the RMS AC voltage between the sliprings is .707 volt for single phase, .612 for three phase and .35 for six phase. Only small variations from these relationships are possible.

REMAINING TYPE

(3) MOTOR CONVERTER. AC input power is fed to an AC stator winding inside of which is an AC armature, usually rotating at half synchronous speed. The AC armature is on a common shaft with a DC armature but there are electrical connections between the two. The total DC power available is the sum of that conveyed by the shaft and the armature.

Since the stator windings have only magnetic connection to the AC input, the machine can accommodate a variety of voltages and phases.

Just in case I should be loath to accept the above definitions, B.M. suggests that I might inspect a number of

(Continued on Page 85)

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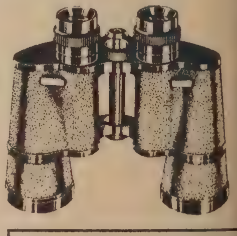

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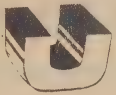

ALNICO MAGNET

Extra powerful, measures 2in x 1¼in x 1¼in.
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(Post 2/6)

NEW MINIATURE PLUGS & SOCKETS

Plug and Jack, 5/- pr.
(Post 6d.)

VALVES

1A3	7/6	6F7	12/6
1K5	3/9	6G6	5/11
1K6	7/6	6H6	1/6
1K7	3/6	6J5	12/6
1LN5	5/-	6J6	12/6
6A6	10/6	6K6	6/9
6AB7	10/6	6K7	3/11
6AC5	10/6	6K8	6/9
6AG7	12/6	6L7	3/11
6AJ5	5/11	6N7	9/6
6C4	3/11	6Q7	12/6
6C8	3/11	6R7	12/6

3AP1 3 inch 37/6
3BP1 3 inch 37/6
5BP1 5 inch 29/6
(Post 9d First Valve. 1d each additional Valve.

CAR COMPASS

This compass is fully compensated and is fitted with a suction cup for easy attachment to the dashboard.
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(Post 2/6).

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With windage and elevation adjustments. Supplied with clamps.
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1,200ft twin sided on 7 inch spools.
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Giro 24 volt motors.
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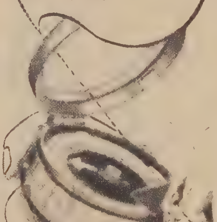

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Step down 240 volt to 110 volt.
300 watt .. £9/19/6
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1,000 watt .. £17/10/
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TRANSCEIVER 22 SET

2-5 Mcs. Complete with power supply, headphones and microphones for 12 volt operation.
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LUCAS army signalling lamps, ideal for spotlights.
50/-
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Headphone Cords

New complete with plug.
5/-
(Post 2/6).

SLIDE CARD COMPUTERS

Ex Air Force Mk. I slide card computers.
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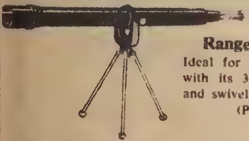
TELESCOPES



Range Telescope
Ideal for range marksmen, with its 30x magnifications and swivel tripod. £7/19/6
(Post 8/6)

Pocket 'Scope
Supplies 25 mag. Folds neatly into a pigskin case which fits the pocket nicely.
£3/19/6
(Post 4/6)

Army Angle 'Scope
Supplies 6 magnifications. Complete with self-attached base for mounting.
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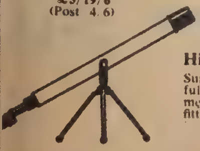
(Post 8/6).



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Supplies 50 mag. Beautifully finished in white enamel with black and chrome fittings.
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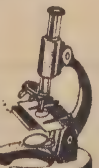

TWIN LENS: Supplies from 80 to 600 magnifications. Complete with slides and built-in lighting. Supplied in a polished wooden box.

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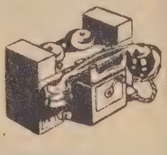

No. 38 set complete with headphones, microphones, aerial, control box, and spare set of valves. Approximate range 2 miles. £8/12/6.
(5/- Delivery to Rail)

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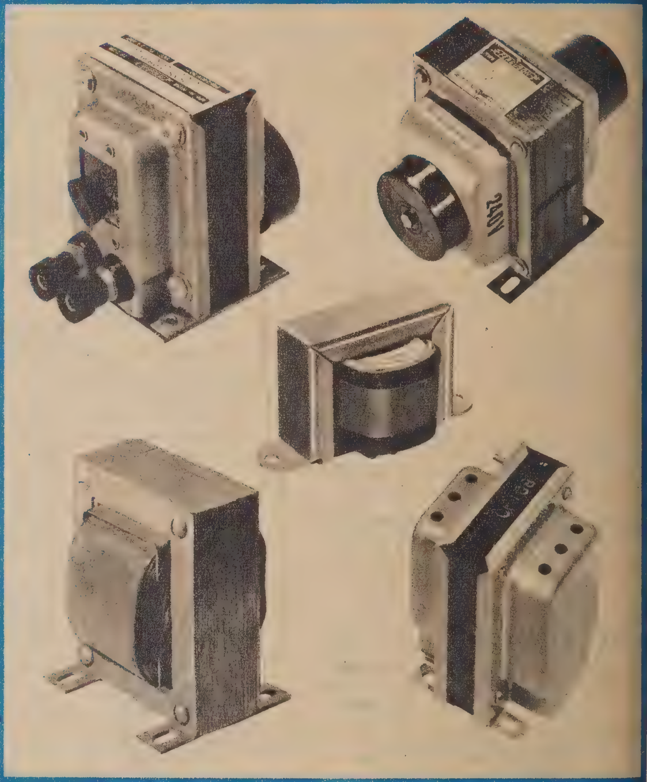

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Brisbane—Keith Percy & Co. Pty. Ltd.,
Waterloo St., Newstead, 2-1757.

Perth—Athol M. Hill, Durham House,
842 Hay St., 21-6987.

ferences (quoted) plus machine name-ates in various substations and rail-ay installations in the Newcastle I.S.W.) area.

He suggests further that we might ve been confusing a rotary converter th either one of the types of motor nerator described in 1a or 1b. The pe described in (3) is a very uncom-on machine.

Since I cannot be sure, at this remote te, who wrote the original paragraph "Answer Tom," I cannot be sure who istook which for what. I suspect, how-er, that the paragraph is simply the oduct of loose terminology among adio" types, as contrasted to "elec-cal," when it comes to talking about ectrical things.

HE FIRST NAME HANDY

For the same reason, I doubt that om" deliberately chose the term he d, rather than another.

I have the impression that radio personnel, when faced with a machine that es round and round are likely to call a "motor-gen." a "genemotor," a "con-rter," "rotary converter," "motor ernator" plus, possibly, a few others, thout too much attention to what goes i what comes out and, if so, why!

From now on, however, we should ve no excuse. Thanks, B.M.

Having started off in the vein of things that should have been said better -or not at all—we may as well continue.

In the letter, centre column, a Brisbane reader picks out a statement made b a contributor in our October, 1960, issue. In particular, he refers to Reg Johnson's article on the Solar Heater and t a statement in column 3, page 71.

After discussing the wavelength of in-cent solar energy and the significance o the surface colour and finish to the amount of energy absorbed or reflected, Reg Johnson says:

'It is also a fact that a good absorber is also a good emitter. For instance, if w heat a black and white billiard ball to the same temperature and allow them to cool, it will be found that the black ball loses heat faster than the white. It can be shown that the difference in the rates of cooling is proportional to the difference in absorptivity of the two balls."

ET "HATE"

Herein lies our correspondent's "pet hate." Perhaps I can take it on myself to expand and interpret his line of reasoning:

When an object — in this case a solar heater — is exposed to the full rays of the sun, it can absorb energy over a wide range of frequencies, including those in the visible spectrum.

When the object is painted flat black, it appears so to our eyes because it is absorbing most of the rays in the visible spectrum. If the finish has a gloss and/or looks visiblv lighter, it is indication that less of the light energy is being absorbed and more is being reflected.

Since the purpose in a solar heater is to absorb as much energy as possible, there is good argument in favour of painting the surfaces so that they appear to the eye as flat black. This point is not in dispute.

The energy absorbed serves to raise the temperature of the heater unit and, of course, the water which it contains.

One of the consequent problems is to curtail loss of this heat by convection or re-radiation, the former being discouraged by covering the exposed elements with a sheet of selected glass.

As far as re-radiation is concerned, this loss of heat takes place at frequencies way below the visible spectrum—in a region where the VISIBLE colour of the surface has no immediate bearing on the emissivity.

Our correspondent, R.G., quotes figures which indicate examples of substantially uniform emissivity from surfaces which range all the way from white to black. He further claims that what differences there are, are related to surface and texture rather than colour as such.

In the light of this, the billiard ball illustration falls down rather badly. Exposed to the sun, the black ball would doubtless heat up more rapidly than the white ball, because it would absorb more of the energy from the sun's rays.

However, assuming that both were actually raised to the same temperature, then allowed to cool, the rate of cooling would be much the same, since the heat radiation would take place in a portion of the frequency spectrum where visible colour had little significance.

RADIATION OF LIGHT AND HEAT

Dear Mr Williams,

In your October issue Mr Johnson excellently covered the problem of solar water-heater design. However, his error about the heat loss from black and from white billiard balls is my pet hate.

The error was being made in 1879 when the 9th edition of the Encyclopedia Brittannica interestingly observed (vol. VII p526) that the Ermine had white fur in the winter so as to reduce the loss of bodily heat.

The fact is that emissivity and absorptivity, to have meaning, must have a wavelength or band of wavelengths ascribed. Absorptivity to light or otherwise colour has no relation to emission of heat.

Reference to good authorities such as McAdam "Heat Transmission" will show Thermal Emissivities, e.g.

Aluminium paint, 0.27 to 0.67.

White fused enamel on iron, 0.90.

Grey marble, 0.93.

Oil paints, 16 different colours, 0.92 to 0.96.

Candle soot, 0.95.

The differences between these values are due to polish or smoothness and not to colour. An appreciation of this fact is necessary to the best practical design of solar heaters, to the design of houses and indeed to all considerations of heat transfer.

Yours faithfully,

G.R.G. (Chartered Engineer).

Rebuilt Picture Tubes

Dear Sir:

An article entitled "Rebuilt v. New Picture Tubes" appeared on page 57 of your December, 1960 issue. It seems likely that this article could lead readers to an inaccurate conclusion about the Australian position.

In the first place, the introductory remarks to the main article state that the problem is not yet with us in Australia. In actual fact there are already operating in Melbourne two firms, Nu-Vu and Ultravision, which specialise in rebuilt picture tubes.

Not only, therefore, is the problem facing us, but these firms claim that the recent considerable drop in the price of picture tubes and the doubling of the guarantee period are conditions brought about and maintained solely by their operation in this field.

It is well known in the trade that picture tube manufacturers have been rebuilding tubes for several years; however, they have omitted to label them as such when re-sold.

Despite the claims of the original article about conditions in America, I have encountered two cases where new tubes from one particular Australian manufacturer have displayed washed-out pictures and marked screens consistent with worn-out phosphor screens.

By contrast, the two firms mentioned announce that in the near future their rebuilds will feature new screens as well as new guns.

To my mind, the article as a whole simply adds to the confusion which the American manufacturers are so anxious to preserve. For instance, one of America's largest manufacturers markets a first-quality picture tube in which everything, even the glass, is new.

This first-quality tube, the advertisement suggests, without actually saying so, is superior to their own rebuilts, despite the assurance that "there's no finer rebuilt made." However, the original article asserts that a factory rebuilt, with new gun and screen, is in every way equal to new.

When two prominent manufacturers issue contradictory statements, whom are we to believe?

In view of these observations the problem facing us in Australia is, I suggest, to decide between paying a higher price for a new tube, which may in fact be a rebuilt, and paying a lower price for an acknowledged rebuilt.

When rebuilt tubes are supplied with new screens as well as new guns, we can confidently buy them with the assurance of the Sylvania company that they are indistinguishable from new.

Yours Faithfully,

M.G. (Glenroy, Vic.)

BUILDING AN AMPLIFIER ?

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Then there's a Quality TRANSFORMER *. . . for the Job!*

AMPLIFIER	OUTPUT TRANSFORMER	POWER TRANSFORMER
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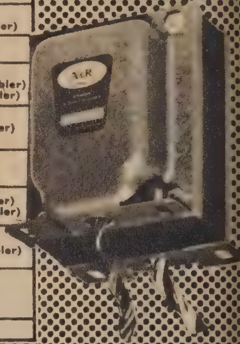
Mullard 3-3	OT933	PT2073 (60mA)
Mullard 5-Stereo-T	* OT4005 (Two)	PT1896 (150mA) PT2065 (150mA Volt. Doubler) PT2066 (190mA Volt. Doubler)
Mullard 5/10 Pentode Low Loading	* OT2525/8 or /15	PT2073 (60mA) PT2063 (80mA Volt. Doubler) PT1890 (100mA)
Mullard 5/10 Pentode High Loading	* OT2525/8 or /15	PT1886 (80mA) PT1894 (125mA)
Mullard 5/10 UL43% Turns	OT2540/8 or /15 * OT4000/8 or /15	PT2063 (80mA Volt. Doubler) PT2064 (125mA Volt. Doubler)
Mullard 5/10 Two Amps for Stereo or RTV & H Stereo	OT2540/8 or /15 (Two) * or 4000/8 or /15 (Two)	PT1937 (200mA) PT2066 (190mA Volt. Doubler)
Mullard 20W	* OT4001/8 or /15 Hermetically Sealed	PT1902 (180mA encased) PT1783 (180mA) CHOKES Z3043 or Z3008

* Output Transformers marked thus (*) have Grain Oriented Silicon Steel Cores.



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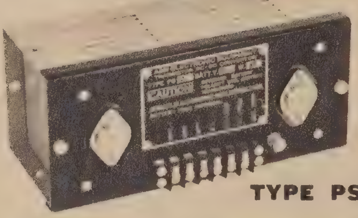

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D.C. Output Power: 60 watts maximum.
D.C. Input Current: 5.9 amps. at 60W. output.
D.C. Output Voltages (14 V. in.): 400, 300, 200 or 150 V.; 400 & 200 simultaneously or 300 & 150 simultaneously.
D.C. Output Current: 150 mA. maximum total from full and half voltage taps or 150 mA. each if switched to alternate loads.

Efficiency: 78% at 60 watts output.
Operating Frequency: 1 Kc/s.
Maximum Operating Temp. (i.e. ambient air temp. at point of installation) 150°F. (approx. 65°C.).
Filtering: Adequately filtered in full voltage output lead and provision for filtering in half voltage output.
Dimensions Overall: 8 in. x 3¾ in. x 3¾ in.
Mounting: Universal type.
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I'm afraid all this adds up to a rather ong case and our contributor, Reg hnson, may have a hard job talking it wn. But, if the worst comes to the rst, one could be in less desirable mpany than the Encyclopaedia Brit-nica.

So much for the argument. From a actical viewpoint, the situation remains changed. Elements of the solar heater ould still be finished in flat black.

To change the subject yet again, a ıder from Glenroy, Victoria, questions r introduction to a brief article re-nted from the "Sylvania News," a ochure put out by the makers in Ame-a of Sylvania valves.

You will probably be interested to read at he has to say about Australian re-ilt picture tubes and the alleged in-ence on prices.

However, I seriously doubt that any-ng in his letter proves that we are, in t, faced with the kind of problem that mentioned in the reprint.

For example, we don't have "some 150 ınds of rebuilt tubes on the market." be sure, there is a vast difference in scale of things but think of the sheer possibility of keeping track of that ny rebuilding concerns, many of them parently not too honest in their claims d activities.

Nor, to my knowledge, have the ac-ities of local manufacturers or rebuild- warranted the attention of a body ıivalent to the Federal Trade Com-ssion.

But don't get me wrong in saying this. ertainly cannot vouch for each and ry tube released for sale on to the al market, nor for every word of ad-tising that may have appeared.

But I do think that the remark which roduced the reprint is essentially true. stralian viewers and servicemen are faced with the problem—of anything the magnitude—which currently con-nts their counterparts in the U.S.

Let's hope it stays that way.

★ ★ ★

Last month, you may remember, we blished a letter from a reader in mberwell, Victoria, questioning the is of radio clubs involving school-s. Amongst other things, he wanted know "Why must they be limited to resting youth in Amateur Radio and electronics generally?"

We made a few remarks about all this but it so happens that a letter from another teacher in Collingwood, Victoria, reached us in time for publication in this issue. Since it makes useful contribution to the subject under discussion, we publish it in full, as under: —

"Dear Sir,

"Mr Fisher seems to be under some misapprehension when he asks why must Radio Clubs be run by Licensed Amateurs and limited to interesting youth in Amateur Radio. I know that a transmitting set may be an added attraction to a radio club but the members' activities will be rather limited.

"Our School has a Radio and Electrical Club and its activities include a very wide range of both. Just recently the two groups have been separated with two members of the staff acting as leaders.

"The School Magazine each month publishes an article on the activities and records the section of the project being dealt with. The radio circuit, together with details, are set out and the construction and operation are dealt with during the club period.

"I have been interested in listening in, both DX and S.W. for a very long time and I recently applied through the Short Wave Section of the W.I.A., for any assistance, modern ideas, etc., which would help us improve the club. Our aim is to interest the boys in radio and electrical work, give them some working knowledge and help to develop their skill in making up simple sets and devices.

"If a boy becomes interested enough to take up this work for his occupation he may then enrol in the Senior School and continue his studies.

"Last year many of the members made simple crystal and transistor sets; this year we are starting with Short Wave Listening. Some of the members have dual-wave sets at home and are being given hints on better listening on short waves. The local Short Wave Branch of the W.I.A., has offered to help us and we hope our members may become interested enough to join the branch at a later date.

"Questions on any problems, radio, electrical or electronic are answered with the assistance of other staff members.

H. C. Major
(Club Leader, Radio Section, Collingwood Technical School, 35 Johnston St., Collingwood, Victoria)."

Dear Sir,

Some months ago a group of wartime radar personnel met and formed a Radar Branch of the Air Force Association.

Knowing that so many wartime radar mechanic types have continued in radio as a hobby and so subscribe to your magazine, we would appreciate any mention you can make in your publication regarding this.

Aims of the Radar Branch are as follow:

1. *To enable members and former members of the R.A.A.F. Radar organisation to renew and continue the friendly contacts made during their period of service.*
2. *To meet and march in the Anzac March as a body.*
3. *To organise and conduct such meetings and functions as considered necessary in the furtherance of radar.*

Meetings are held on the fourth Tuesday of each month at 6.45 p.m. in the Air Force Association rooms at 330 George Street, Sydney.

New members are welcomed at meetings and judging by the growing membership, at present approaching 80, and the friendly enthusiasm, the new organisation has a rosy future.

Further details can be obtained from the honorary secretary, Mr Gordon Thomas, of 4 Kings Avenue, Roseville (JA2693).

JACK C. FRASER,
Publicity Officer (YU7878).

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ECONOMICAL STEREO AMPLIFIER

Designated the "Eight-Eight" Stereo Amplifier, the unit shown below has recently been released by the Servo Mechanism Co., a division of Medding Industries Ltd. With a power output (rms) of four watts per channel, it is designed for people wishing to get into "Hi-Fi Stereo" at a minimum expense.

THE unit is available in either chassis form or in a "Fler cabinet" as illustrated. Controls included are input selector, volume, balance, treble and bass, with switches to allow monophonic operation or stereo reverse connection. A primary voltage selector and fuse are fitted to the rear of the chassis.

An outlet is available for connection of tuners, etc., to the HT and heater lines of the amplifier. Output impedance is 15 ohms standard, with internal facilities for conversion to 3.75 ohms. The valve complement is six, including two electron-ray tubes used for balance indication, plus two silicon diodes used in the power supply.

The sensitivity is quoted at 120 mV for full output, making it suitable mainly for crystal types of cartridge. Frequency response is quoted as 3db down at 10 c/s and 40 Kc, total harmonic distortion at full output at 0.9 p.c., and hum and noise at 57 db below full output. Tests in our laboratory indicate that these claims are well founded.

Provision for only two inputs is provided, being for tuner and pickup, but
both are wired for stereo signals. Th
would enable a dual FM-AM stere
tuner to be connected if desired. Alter
atively, the output from a stereo tap
recorder could be fed in via the tun
input.

The instrument supplies both vide
and RF output. Video signals are take
from a low impedance cathode followe
via an isolating capacitor to permit co
nection to "hot" sections of the circu
Video output is variable up to six vol
peak to peak and may be of either pos
tive or negative polarity, as selected.

Altogether, a nice amplifier in th
medium-price field. Retail price is quote
at 65 guineas, or 56 guineas without th
polished cabinet. The manufacturer's a
dress is 505-11 Lygon Street, East Brun
wick, N.11, Victoria. (J.R.)

"TELESLAVE" PHONE MONITOR

OF particular interest to busine
organisations, professional men, et
is the "Teleslave" telephone answeri
machine currently being distributed
Brown and Watson Electronics Pty. Lt
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This machine can monitor a telepho
channel 24 hours a day. It answers a
incoming calls, advises the caller th
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dictate any message for recording
tape. The pre-recorded announcem
may be up to 40 seconds' duration, a
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mined duration up to six minutes. Th
minutes is the usual recommend
period.

Total recording time available
three hours, more than sufficient for
normal requirements. The machine
fully approved by the P.M.G.'s Depa
ment for direct connection to inter
or external lines.

"PRECISION" DOT AND BAR GENERATOR

ANOTHER very attractive instrument in the "Precision" Range, currently being distributed in Australia by R. W. Steane Pty. Ltd., is the Model E-420 Dot and Bar Generator. Intended for final adjustment of TV receivers it provides facilities for horizontal and vertical linearity adjustments, plus colour receiver convergence tests.

WHITE DOT — BAR GENERATOR

Although the latter facility is not likely to be needed in Australia for some time, the bar pattern section is virtually essential in any progressive TV organisation.

This generator delivers both vertical and horizontal bars either separately or combined in a "cross hatch" pattern. The vertical bars may be varied from 12 to 20 and the horizontal from 8 to 16. The width of the bars is variable in both cases. Colour convergence dots are variable between 12 to 20 per line and variable in size.

The RF output is continuously variable over a wide frequency range and up to 100,000 microvolts maximum output. It is fed to the aerial terminals of the receiver via a 300 ohm low loss balanced cable.

The quality and finish of the instrument are of the usual high order associated with "Precision" equipment, and the instrument is a fitting companion to similar units previously described.

Further details and price from the distributors.

NEW "Q-PLUS" BIAS COIL

HE bias/erase coil pictured has been produced by R. W. Steane Pty. Ltd. ecially for use with the Collaro Tape udio" Type Transcriptor. The sec- ary impedance has been designed to vide a good match with the erase d used on the Collaro deck which is he high impedance type.

ested in one of our recent projects, coil exhibited greater activity than type previously used due, no doubt, the increased "Q" effected with a le pie winding. Used in a standard llator circuit, there is no difficulty eloping more than adequate voltage upply the erase head.

he coil is very small physically, suring some 1¼in long by 1in in dia- er. It is mounted simply by pushing

t a five-sixteenths diameter hole, a ng clip automatically holding it in ion.

esignated as type C6, the coil is able through trade houses. Trade iries should be directed to the manu- rers or the N.S.W. agent, John Ran- and Co., 8 Cadow Street, Pymble. priced at 13/3 retail.

* * *

ACOBY MITCHELL IN ADELAIDE

COBY, MITCHELL & COMPANY TY. LTD., of 469-475 Kent Street, ey, announce that they have estab- d a branch office in Adelaide.

e manager of the new branch office r H. A. Pile, formerly sales engi- with the Adelaide firm of Gerard Goodman Ltd.

uring the war, Mr Pile served with R.A.A.F., working on airborne radar ment.

ter the war he was employed for mber of years in the Communica- Laboratory of the State Electricity mission of Victoria. Mr Pile holds roadcast Operator's Certificate of ciency, which he obtained while oyed by the Electricity Commission.

e new Adelaide branch will be n as Jacoby Mitchell Electronics the address is 77 Wright Street, aide, telephone No. LA5117.

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All Brands from £27/10/-

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"NOVA" SURGE SUPPRESSOR

Size A—For Projectors and globes to 150W	29/6
Size B—For Projectors and globes 200W to 300W	32/6
Size C—For Projectors and globes of 500W	35/6

When ordering by mail add 2/6 for registered postage.

TRANSFORMERS (Audio, Power, Transistor, etc.) to your or any specifications. Rewinds a specialty.

BIAS/ERASE OSCILLATOR Coils for all makes of tape-decks and heads.

Send self-addressed stamped envelope for details of our products. Tape heads 2 and 4 Tracks, Stereophonic. Many makes.

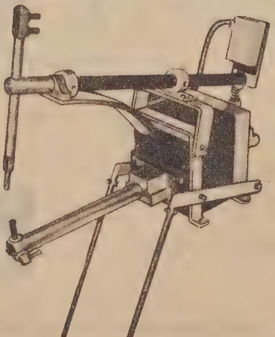
WANTED!

Good used Tape Recorders, Communication Receivers and Transistor Radios and F/M Tuners.

We sell on terms and pay you cash.

THE PHENOMENAL NEW

"NOVA" SPOTWELDER



A unique 'open' construction with glass insulation enables an enormous reduction in size and cost. Combined with highest water-cooled efficiency.
1/2.5/5/7.5 KVA

311 SUSSEX ST., or 122 WILLIAM ST., SYDNEY.
BM6138, FA8393. XY6721 after hours

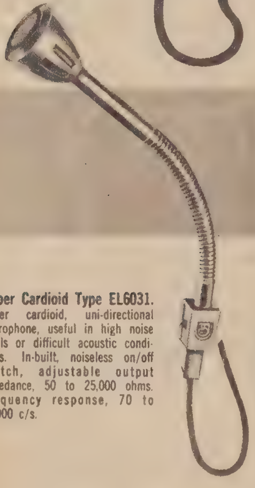
Please write for complete price list of new and used recorders.

Which **PHILIPS** microphone is best for your purpose

Dynamic Type 1100 or 1101. Here is a robust, general-purpose microphone giving reliable service and excellent intelligibility even under high-ambient noise levels. Available in 50 ohms. or high impedance. Frequency response, 100 to 7,000 c/s.

Dynamic Type 1114 or 1115. Recommended for tape recording and general stage work. Styled for hand use or stand mounting. Frequency response, 100 to 10,000 c/s.

Pencil Microphone Type 1116 or 1117. Ideal for general studio use (for roving and orchestral pick up) and all applications requiring a high-quality microphone. Frequency response, 35 to 15,000 c/s.



Hyper Cardioid Type EL6031. Hyper cardioid, uni-directional microphone, useful in high noise levels or difficult acoustic conditions. In-built, noiseless on/off switch, adjustable output impedance, 50 to 25,000 ohms. Frequency response, 70 to 15,000 c/s.

Omni-directional Type EL6021. A non-directional, moving-coil microphone for recording, broadcasting and all high-quality P.A. systems. In-built, noiseless on/off switch. Adjustable output impedance. Frequency response, 60 to 15,000 c/s.

Moving Coil "Pencil" Type EL6040. For highest quality broadcasting and stage work. In-built, noiseless on/off switch and adjustable output impedance, 50, 500, 25,000 ohms. Frequency response, 35 to 15,000 c/s.

Choosing the microphone **YOU** need is no problem with the Philips range of microphones and the Philips **FREE** Sound Advisory Service. Consult this service for all your sound problems.

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TECHNICAL BOOK REVIEW

HE STORY OF STEREO: 1881, by John Sunier. Gernsback Library ok No. 98. Stiff paper cover, 160 pp. x 5½ inches.

lot of research has gone into the paration of this book which, as the suggests, traces the development of eo (or multi-channel) sound reprotion from the filing of the first patent 1881 to the present day.

he material throughout could be read ease and pleasure by the average io enthusiast, illustrated where neces- by sketches, diagrams and photophs.

fter a couple of general introductory pters, separate treatment is given to eophonic sound on film, sound on , sound on disc, and stereophonic adcasting.

final chapter on techniques includes rence to various simulated and ido-stereophonic systems which have er been devised or are under current elopment.

or those who want to investigate ters more closely, each chapter is ompanied by a lengthy list of referes and the book itself carries a ded subject index. In short, a full and resting package of information on a ect of current interest.

Our copy from the publishers. Sup- should be available in due course ugh local booksellers.) W.N.W.

★ ★ ★

TO Z IN AUDIO, by G. A. Briggs. Technical Editor R. E. Cooke, B.Sc.). Stiff covers, 224 pp. 8½ x 5½ es, published by Wharfedale Wire- Works Ltd., England.

espite the title, I was mildly surd to find that this book is, in fact, ossary of names and terms which oncoming audio enthusiast is likely ncounter. The author has not atpted to provide a complete glossary has preferred, rather, to limit the to about 400, expanding some exations to one or more pages.

me of the material and illustrations borrowed from Briggs' earlier books the bulk of it is new.

imagine that the book could have roles—one as a glossary, the other browsing" material for anyone with, et, limited knowledge of audio techities.

this latter role, the Briggs brand of nality and humour provides relief what might otherwise be an unesting list of terms.

ur copy from McGills Agency, 183-5 beth Street, Melbourne, Australian 26/6 including postage. W.N.W.

★ ★ ★

NDBOOK OF ELECTRONIC TABLES AND FORMULAS, by ld Herrington and Stanley Mea. Hard cover, 128 pages, 8½ by 5½ s. Published by Howard W. Sams Co. Ltd., Indiana, U.S.A.

is handbook has been compiled to the specific needs of students, engi- and technicians in the electronics try. Designed to give fast access to d facts and figures, it is a handy ilation of the equations, formulas, eference data with which they work

Part one lists the basic formulas and laws for power, resistance, capacitance, inductance, coupling coefficients, Q factors, resonance, admittance, susceptance, conductance and reactance, impedance, power factors, frequency, transmission line characteristics, coil windings, decibels and others. A number of nomographs are included to speed the solutions of problems involving Ohm's law, power and reactance.

All codes, symbols, mathematical constants and international standards that have come into general use are defined in part two. Of particular interest is the comprehensive table of conversion factors, needed frequently in electronic computations.

Service and installation data is the title given to part three of the book. This section supplies much useful information on such things as coaxial cable characteristics, valve substitution, relay rewinding data, machine screw and drill sizes and a copper wire table. Some of the subjects covered, such as light properties of colour TV, will not be of much interest to the Australian technician at the moment, but it could be useful in the future.

Part four of the book is devoted to mathematical tables and formulas and covers such things as the decimal equivalents of fractions, algebraic operations, geometric formulas, trigonometric functions and formulas and common logarithms and anti-logarithms. This chapter is a particularly handy one, as it enables the user to make light work of the calculations involved with formulas given earlier in the book.

The fifth and last chapter is entitled "Miscellaneous" and consists of various tables and charts which did not come within the coverage of the previous chapters.

This book should meet the needs of both student and engineer alike, making it unnecessary to refer to three or four reference books to find needed information.

Our copy came direct from the publishers. Copies should be available on the local market in the near future. K.W.J.

★ ★ ★

WORLD RADIO HANDBOOK: A review of the "World Radio Handbook," Sixteenth Edition, was included in the notes for short-wave listeners, on page 117 of our February issue.

It has been brought to our notice that the price mentioned was the official sterling price, with no allowance for postage or for exchange rate, when sold on the Australian continent.

Australian price, including postage, is 27/3.

★ ★ ★

PRACTICAL AUTO RADIO SERVICE AND INSTALLATION: A review of this new book by Jack Greenfield appeared in our last issue. As mentioned, the review copy came direct from the publishers, the book being listed as Gernsback Library Book No. 87.

A letter to hand indicates that the book is now available in Australia from Electronics Publications (Australia), 11 Cadow Street, Pymble, N.S.W. Australian price is 29/9.

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FITTINGS: Designed in co-operation with RMA Committee, combining all features of P, O and XL Series. Gold plated contacts. Rubber relief collar and bushings.

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Specialized "LK" and "LKT" plugs used on television cameras and related equipment.

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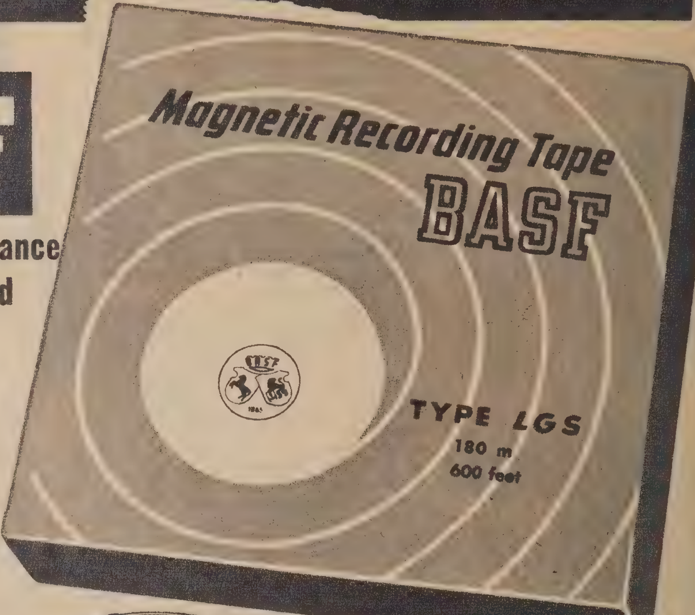

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THE FACTORY SEAL. Your guarantee of brand new tape.

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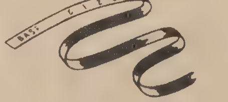
Prevents unravelling.



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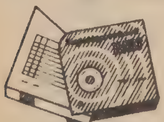
For automatic stop recorders.



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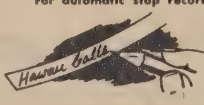

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300′ x 3″ £1
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P82

OFF THE RECORD — NEWS & REVIEWS

WIDE INTEREST IN HI-FI STEREO HEADPHONES

As we had anticipated, our article in the January issue on the subject of high fidelity stereo headphones created a tremendous amount of interest. More than that, it started an activity locally which will probably remain a facet of hifi listening from now on.

By Neville Williams

is not surprising that the first reaction was from readers, who had ady delved into stereo headphone lis- ng, though in every case with head- nes less suitable for the purpose, than AKG type now available.

ne reader who called to see us had him a pair of conventional low edance ex-disposals' phones rigged up suitable cords, which he said he been using with good results for some time.

hile he agreed that frequency re- se may have left something to be ed, he stressed a practical point which orthy of repetition, namely the im- ance of using hard-wearing cords terminating them properly.

CIAL PLUG

ith this in mind, he had terminated ords in the type of phone plug using insulated sections at the tip, as well e barrel portion. He had found this offered much greater resistance rain and possible breakage than by ly terminating the cords in a miniature 4-pin speaker-type plug and socket.

e quite see the point of this and st that, where the 4-pin plug and t is used, the cord be suitably or wrapped so that any strain is on the cord as a whole and not e individual soldered connections.

other reader from South Australia rded a pair of phones for our in- ion, which he personally had been . These were Browns type A, hav- much better response than the dis- s type. This reader had also ob- d the significance of phasing and fitted the switch seen in the photo- , to allow it to be changed at will. ograph and excerpts from his let- ppear on the next page.)

G AND SOCKET

contribution to the "mechanics" of one listening is a suggestion that h cord be used to allow reason- freedom of movement, and, further, he wiring be arranged so that any n or undue strain will pull a plug f a socket.

saves getting your ears pulled off, u go to walk away, while still ng the phones!

use of headphones other than pe specified was one of the things oked into very early in the piece, ithout encouraging results.

se we have been able to try in- two pairs of ex-disposals low im- ce phones of different type, a of pairs of typical high imped- commercial phones, wartime dynamic units with muffs, Browns type A, crystal and magnetic hearing aid types and a pair of supposedly high-fidelity prewar phones.

In all cases, the response curve was sufficiently plagued by peaks, troughs or slopes to impart a notable degree of colouration to the sound.

This latter term is used quite deliberately. In almost all the phones it was possible to hear frequencies over a very wide range, right up to the limit of hearing, in fact. However, this is not sufficient reason to claim a response from here to there. As with pickups and loudspeakers, the vital thing is not so much the limits of perceptible response, but its correspondence or otherwise with "level."

Peaks, troughs and slopes "colour" the sound in obvious fashion and cause people to use such adjectives as "tinny,"" "metallic," "dull," "boomy" and so on.

Thus, while one can gain quite startling "stereophonic" effects with almost any class of headphone, on very, very few is the quality likely to be of an order to interest an audio enthusiast.

ENTHUSIASTIC REPORTS

Against this, subsequent events have only served to confirm my initial appraisal of the AKG phones.

Chief engineer of a large audio components manufacturing concern rang me to summarise the results as "nothing short of fantastic."

A service technician, himself an audio enthusiast and one of fourteen in a big service organisation, rang to say that they had managed to get three pairs of phones between them, and that another eleven pairs were on order!

A wife who had threatened her husband with divorce (or worse) if he spent eleven pounds "for those things," ended up by telling me how good they were!

Perhaps I should hasten to say that I make these remarks about the AKG phones because they happen to be the only ones available locally at the moment which are expressly designed for high fidelity stereo listening. (At least, as far as I know).

Overseas a variety of other types are listed, but I have no personal knowledge of their relative merits or demerits.

In fact, there appears to be a very sharp rise in headphone listening on a world-wide basis, and this is complicating the problem of those who are trying to meet the Australian demand. They have asked me to assure readers that supplies of headphones will be released just as rapidly as they become available.

Among those who have received their phones and put them into service with existing amplifiers, are some who have run up against a problem which was not specifically covered in our initial article —namely the problem of hum.

HUM PROBLEM

When the phones have been connected across the transformer secondary windings in place of the regular speakers, they have suddenly realised that their pet amplifier was not as free from hum as they had previously imagined.

In such a circumstance, two courses are open: (1) To cure the hum or (2) To modify the headphone coupling circuit to render the hum less important.

I cannot well embark here on a discourse about curing hum, but it may involve adding extra filtering and/or decoupling electrolytics, checking valves, and heater circuits and re-routing input wiring to avoid earth loops. If hum can be reduced by any or all of these methods, it is a good thing to do any way.

An alternative approach, at least in 15 ohm secondary circuits, is to tap the phones across portion only of the 15 ohm load resistors, which have been substituted for the voice coils. This will necessitate turning the amplifier gain a little higher to compensate, but there is no objection to this, provided the process is not carried so far that the amplifier has to operate too close to overload on peaks.

Obviously, however, tapping the phones down and turning up the signal level must increase the signal/noise ratio, whether the noise is hum or simply amplifier hiss.

Oldest and Smallest

The oldest record in the B.B.C.'s huge record library is a seven-inch Berliner, made in America on October 31, 1895, by George J. Gaskin, a well-known American baritone of the day, singing a popular song "Sweet Marie." .

The smallest is the Queen's Doll's House record, measuring only 1 and 5/16 inches in diameter. It plays the National Anthem. It was made in 1924 especially for the Doll's House, which is now on permanent exhibition at Windsor Castle.

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SPECIALS!

RECORDING TAPE

1,200ft reels of twin sided recording tape wound on standard 7in plastic spools. **29/6** (Post 3/6).

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15/- (Post 3/-).

PORTABLE TRANSCEIVER

Operates over approximately 2 miles. Complete with microphones, headphones, control box, aerial and spare kit of valves. **£5/12/-** (Post 10/-).

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Ideal communication between two offices. Simply join with one wire. No extras needed.

7/6 each or 15/- pair. (Post 3/-).

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Aer — RF — Osc
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13-42 metres. 16-50 metres.
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5/- each. (Post 1/- each).

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175 Kcs — Medium Selectivity. **5/- each.**
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AERIAL WIRE	3/6
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THE BOYS BOOK ON CRYSTAL SETS	3/9

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FAMOUS MAKE SPEAKERS

10 inch Whitley with universal speech coil.
3-7.5-15 ohms
£12/-/-

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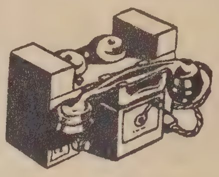

Telephones will save you time and money. Connect them between office and shed or factory. Cheaper than P.M.G. extensions; no yearly rentals.

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POCKET TELESCOPE

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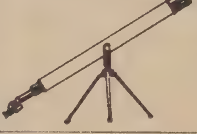

Supplies 50 Magnifications through a blued lens. Finished in white enamel with black and chrome fittings.

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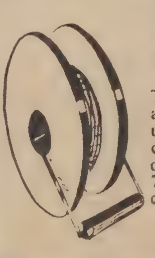
22 GAUGE ALL PURPOSE WIRE



This wire is suitable for any purpose that rope is used for, but it is far, far cheaper. You get 3,000 feet on a wooden reel for only 7/6. Use it for gardening, clotheslines, bell wire, etc.

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BARGAINS!

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1D8	5/-	6L7	12/
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1K7	3/6	7A8	5/
		7C5	2/1
1P5	1/6	7W7	2/
1T4	4/6	12A6	7/
1L4	7/6	12J5	10/
6AB7	6/-	12K8	11/
6AG5	6/9	12SJ7	9/
6AJ5	9/6	12SH7	10/
6G6	12/6	12SR7	4/
6J6	12/6	807	11/
6J7	4/9	809	19/
6K7	3/11	832A	35/

(Post 1/- 1st valve, 1d additional valve i.e., three valves 1/2).

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Ex army morse key with high pitched, variable tone buzzer mak an ideal sending and receiving set **12/6** (Post 3/6).

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Very modern transceiver as use by todays Australian arme forces. Modified for crystal con trol.

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Suitable for domestic TV Re ceivers. Complete with valve ready for installation.

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These rods replace the norm aerial coil with external aerial an thus improve selectivity and sens tivity greatly.

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NEW! HEADPHONE CORDS

Brand new, complete with plu **7/6** (Post 1/-).

NEW! TEST PRODS

8/6 pair. (Post 1/-).

couple of readers have also queried us the possibility—and availability "muffs" to seal in the air between eadphones and the eardrums.

oustically, the use of suitable muffs d be an advantage, though it may the phones less comfortable to , both because of weight and lack entilation in the enclosed space.

owever, I understand that muffs have devised overseas for the AKG es, though not necessarily by the al manufacturers. Local distribu- I believe, are looking into the ques-

the meantime, however, don't go with the idea that the muffs are erequisite to good listening. The you will hear from the head- es, as they are, is directly compar- with the sound you hear from a quality wide-range loudspeaker n.

have used the AKG phones quite since writing the first article on bject, both for mono and for stereo ing.

e ability to listen to mono records, out involving other people, is a y facility, but it carries no special t on the listener. Rather does it line the fact that mono reproduc- needs the "liveness" of a listening to give some dimension to the e of sound.

Y DIFFERENT

reo on headphones is a very dif- experience. You are transported an acoustic environment which, ner artificial, or not, is completely endent of your immediate surround- As I said in the original article, it rd to realise that the room is not, act, filled with the sound which to be all around you, that your anions, reading or chatting or ing television are completely un- of what you are listening to.

t unexpectedly, this kind of reaction triggered off speculation about er stereo records, intended for peaker reproduction, can be "doc- " electrically to bring the sound to the ideal for binaural listen- s is involved in headphones.

ave seen reference, but without any s, to binaural adaptor circuits are presumably supposed to have such effect.

this stage I am rather dubious the need for or the wisdom of circuitry, if only because stereo re- are made by a variety of tech- s, all aimed a getting the desired through stereo speakers.

ere the original recording has been with a single stereo microphone, y contain information not too far ved from binaural requirements. many records are compounded multiple tracks fed by multiple phones.

this moment, I am much more sted in speculating whether, if in- in headphone listening continues ow, we will not ultimately see the e of binaural recordings. These be recorded by the usual 45/45 d and played on ordinary stereo fiers, but would carry information as picked up by microphones in uditorium located in the position and environment of a pair of human ears.

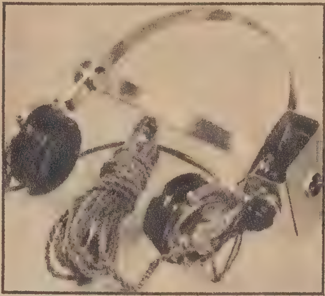
It's an interesting speculation, but, in the meantime, ordinary stereo records sound pretty impressive through headphones.

And there, I am afraid, I must leave the subject for this month.

KEEN ON HEADPHONE LISTENING

Dear Sir,—

Your article on hi-fi stereo headphones in the January, 1961, issue was read with much interest.



I have been using headphones for stereo reproduction for eighteen months with very good results. I was boarding and high sound levels, as with speakers, were undesirable. I thought of headphones.

In due course an old pair of Army phones was located and, even though the frequency response was poor and the distortion high, the results were, as you stated, "nothing short of fantastic."

Then came a better pair, Browns type A with adjustable reed. The tested response is from 60cps to 12 Kc.

I am enclosing my headphones for your inspection. There is a phase reversal switch mounted on them for convenience, connected with a plug. This latter makes it easier for storage or for use with a shorter cable and also the cable pulls away from the plug should you tread on the cable while moving around.

Yours faithfully,
I.S.C. (Kimba, S.A.).

A REVIEW OF SACRED RECORDS

JESUS IS CALLING. World Vision Quartet with the Dick Anthony ensemble. Stereo, G.F.M. (Gospel Film Ministry) 48.

This is the first stereophonic disc I have received carrying the GFM label, and I understand that there are quite a few more on the way.

Technically this one is of excellent quality, with adequate but not exaggerated spread, cleanly recorded and with negligible background noise.

The World Vision Quartet is an experienced and well rehearsed group, who bring a program of conventional hymns such as "No One Ever Cared For Me Like Jesus" and "Only One Life," interspersed with spirituals and one or two "Novelty" numbers.

The accompaniments are equally varied ranging from organ, piano and bass to horn, oboe, harp and celeste. In all, it adds up to very pleasant listening.

* * *

RICHARD CROOKS, "The Holy City," "Star of Bethlehem," Mono HMV 7PO 121.

BENIAMINO GIGLI, "Ave Maria" (Bach Gounod), "Agnus Dei" (Bizet), Mono HMV 7PO 234.

Issued in the "Your Kind of Music" series these two 7in 45s have been on sale for some time but were somehow overlooked among my discs awaiting mention.

Both are transcribed from early recordings but the quality is adequate for anyone who has an interest in the artists and the very well-known titles in each case. In short — well worth the modest purchase price if you want a couple of "immortals" from a past era.

* * *

BLESS THIS HOUSE. Carmen Dragon conducting the Capitol Symphony Orchestra. Stereo, Capitol SP8527.

When traditional and essentially simple hymn tunes are "arranged" for full orchestral presentation, I find it difficult to escape the alternative word "dramatised" or the feeling, at times, that the resulting music has been lifted off the soundtrack of some religious drama. Perhaps it's the result of too much exposure to film and television but I start visualising scenes to fit the sound.

The atmosphere is prominent in some tracks in this latest Carmen Dragon disc. "Onward Christian Soldiers," for example, commences as a distant theme and builds to a triumphal march, lacking only a screen on which can appear the words "The End."

I mention the point in particular because, while some will relish the dramatic treatment and the wide dynamic range, others will prefer the more conservative approach.

Technically, the record is of good average quality, though the stereo is not outstanding for its development of space and spread.

The titles will be very familiar to most: "Old Hundredth," "Ave Maria" (Gounod and Schubert) "Bless This House," "Agnus Dei," "Lord's Prayer," "Onward Christian Soldiers," "Nearer My God To Thee," "The Lost Chord" and "Work For The Night Is Coming."

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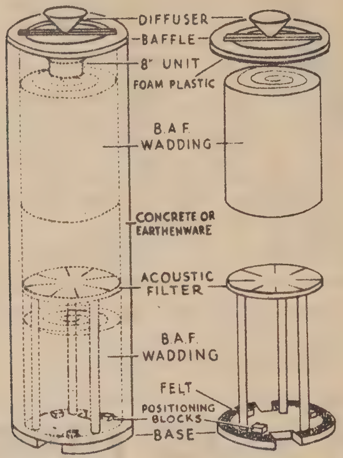

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The pipe is 3ft. long, 9in. inside and 11in. outside diameter, and weighs 106lb.

Inside is an acoustic filter standing on three legs and two rolls of B.A.F. wadding (to counteract the circular shape effects). There is a circular baffle at the top with diffuser, and a wooden base with suitable vent openings. It was necessary to use some plaster on each end of the pipe in order to obtain a level surface for an airtight fit. (Plasticine could also be used for this purpose.) The underside of the baffle is fitted with a layer of foam plastic, and the circular base has a layer of felt on which the pipe rests.

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FROM THE HEART A MIRACLE, Musical Director Thurlow Sputt. Mono GFM (Gospel Film Ministry) 44-W3088-LP.

As I listened to this one, I couldn't help think of the usual family photo-album—photographically a pretty motley collection but of genuine interest to the relatives.

By the same token I guess that this record was eagerly awaited by those who attended the 15th Annual Youth For Christ, International Convention at Winona Lake, Indiana, U.S.A.

To the rest of us it will be — a pretty motley collection with tracks ranging from fairly good to fairly bad.

Having said that, opinion about the technical quality is largely, redundant, but it's average mono.

* * *

GLORY, GLORY, HALLELUJAH. Paul Mickelson conducting the Cathedral Symphony of London and Choir. Stereo, GFM (Gospel Film Ministry) 42.

For this record, Paul Mickelson has at his disposal a 100-strong orchestra and choir, which he uses separately and in combination.

Though a fair amount of arrangement is involved, with plenty of sound level at times, he avoids for the most part the "sound track" effect noted in "Bless This House," reviewed elsewhere.

"Glory, Glory, Hallelujah," from which the disc takes its name will be known to all, as also "A Mighty Fortress" and "Onward Christian Soldiers." The remaining titles will be more familiar by tradition and in choral circles than they will to the average congregation. In short, the music is somewhat less "popular" in content and presentation than most of what has been released to date on this label.

The recording quality is good, average with effective stereo "spread."

* * *

YOUTH FOR CHRIST; Choir, Band and Musicians directed by Paul Mickelson, Stereophonic, GFM (Gospel Film Ministry) 22.

This is one of the more successful of the records I have heard, made of the musical items at an evangelistic youth rally. So often the result is characterised more by enthusiasm and effort than by precision and finesse.

On this occasion — the 1958 Youth For Christ Convention at Winona Lake, Indiana — the music appears to have been recorded at special sessions and under the guidance of Paul Mickelson, now musical director of Word Records Inc.

With choir, brass band, organ, piano and other instrumentalists, the recording captures very well the musical atmosphere of an evangelistic youth rally. The numbers generally are bright, though something else could well have replaced the five-trombone treatment of "When God Is Near."

In some of the selections the stereo spreads the choir in quite dramatic fashion but otherwise the recording quality is of average standard.

For those without stereo equipment, the record is available also in mono.

IN VARIED MOOD

THE INSTRUMENTS OF THE ORCHESTRA, Arranged, Presented and Accompanied by Sir Malcolm Sargent. Stereo, Decca SXLA, 2199.

A presentation of the instruments of the orchestra could easily degenerate into a dry-as-dust sound catalogue.

That it doesn't do so on this disc is due to: (1) Sir Malcolm Sargent's concise commentary; (2) the choice of short, interesting excerpts and phrases from a wide range of compositions and (3) the restrained piano accompaniment which fills in the background but never competes with the featured instrument.

As might be expected, stereo further aids the definition.

With four groove-bands covering strings, brass, woodwind and percussion, the disc should be extremely valuable as a teaching aid. At the same time, its musical interest will give it a wider appeal, while hi-fi fans should find something to listen to, particularly among the 19 individual percussion sounds.

In short—useful and interesting.

* * *

PETER AND THE WOLF, Prokofiev. TOY SYMPHONY, Haydn. Philharmonia Orchestra, conducted by Herbert Von Karajan. Narrator, Peter Ustinov. Stereo, Columbia SAXO 2375.

"Peter and the Wolf," tells the story in words and in musical phrases of how a boy called Peter and a little bird, his friend, manage to capture a wolf.

Though, perhaps an over-simplification of the idea, it can serve in an interesting way to establish in the mind of young listeners a connection between mood, situation and orchestral sound.

In this particular recording the narration by Peter Ustinov seemed rather too forward to me, in relatoin to the orchestra and, at times, somewhat out-of-mood. I doubt, however, that younger listeners will be conscious of such detail.

The Toy Symphony, occupying the last half of side two is a musical trifle combining regular orchestral instruments with "toy" sounds. I doubt that anyone would buy the record for this item but it serves as an appropriate fill for the odd half side.

* * *

FRANZ LEHAR. A Musical Portrait. Victor Hruby and his Viennese Orchestra. Mono. Vox AVX—25560.

The cover notes set out in some detail the musical career of Franz Lehar: His early aspirations as a "classical" composer while still associated with military bands; his rising preoccupation with operettas, including such notable successes as "The Merry Widow" and "The Count of Luxembourg"; the gradually diminishing popularity of the formula, leading to a change in style, influenced further by his association with the late Richard Tauber.

On the two sides, worked into unbroken melody are excerpts beginning with his "Viennese Women" and "Der Rastelbuider," through the "Merry Widow" and "Luxembourg" era to "The Land of Smiles" and "Giuditta."

From start to finish the music is highly tuneful, both in character and in the presentation by the Victor Hruby orchestra.

From start to finish, also, the quality is above reproach. This is a safe choice for "middlebrows," one that will find

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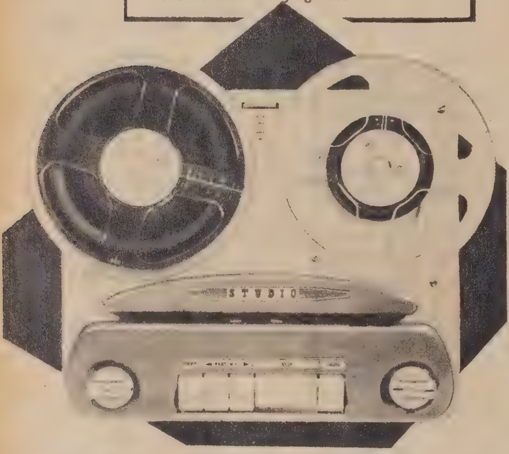

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* * *

A CHORUS OF LOVE from the men of the Robert Shaw Chorale. RCA Stereo SL16261; Mono L.16261.

Despite the title and the attractive lass on the jacket, the men of the Robert Shaw Chorale have not suddenly given way to maudlin sentiment.

To be sure, the songs are all inspired by someone's feelings for his (or their) ladylove(s) but the sentiments vary all the way from the sad to the boisterous and are expressed in the mode of many different nationalities.

With not a note of accompaniment, the Chorale sings its way through all 15 songs in its precise, impeccable style. Whether you find the result pleasant or otherwise will depend almost entirely on your reaction to male voice choirs.

Though the stereo version has some advantage, by reason of the spread which it lends the presentation, both discs are technically excellent.

* * *

DICK KESNER and His Magic Stradivarius, The Music of Hawaii, with orchestra directed by Charles Bud Dant. Stereo. Coral CRL 757352.

If you've a weakness for Hawaiian style music or for sentimental solo violin—or both—it's quite certain that you'll play this record over and over.

For the most part it's in dreamy, romantic, "island" mood but with solo violin, bass and drums taking the lead from the traditional guitar. Two orchestral combinations are used, one large, one much smaller, with occasional support from Hammond organ and with occasional sound effects thrown in for good measure.

The quality technically is excellent, with plenty to occupy the ears of those who like to follow stereo sound hither and yon.

* * *

FORTY ACCORDIONS, Palmer-Hughes Accordion Symphony. Mono RCA Camden. CAM 55.

I was reminded by this disc of the many accordion band titles which were available on prewar 78's, with all their inherent limitations.

By contrast, this latest Camden release offers recording of a very high quality, with not a plop or a fizz to be heard from start to finish.

The 40 accordions include bass and contra-bass instruments, which add so much "weight" to the combination that it sounds at times more like a full Wurlitzer organ.

The titles are "Carmen Suite," "Brazilian," "Sleigh Bells," "Texas Medley," "Arkansas Traveler," "Bolero," "Swedish Rhapsody," "Loch Lomond," "Granada," "Yesterdays" and "Il Guarany Overture."

At the economy price, this disc is a "natural" for anyone interested in accordion music.

A point worth mentioning is that the jacket carries full and appropriate notes, rather than the sales patter which has occupied the reverse side of so many Camden covers released to date.

* * *

MUSIC FOR THE GOLDEN HOURS. Billy Vaughn and his Orchestra Stereophonic, London. SAHA 7527.

Music for twilight hours, music for romancing, music for dancing—such is the recipe for Billy Vaughn's "Golden Hours." And it's Billy Vaughn at his smooth, melodic best, with solo sax in the spotlight most of the time.

On side 1 you get "Deep Purple," "All The Things You Are," "Among My Souvenirs," "Once In a While," "Body and Soul" and "My Blue Heaven."

Side 2 has "Miss You," "How Deep Is The Ocean," "Tenderly," "I Only Have Eyes For You," "Because" and "Embraceable You."

Quite romantic titles to be sure, with the music arranged to suit.

And technically, the recording is of top quality—clean, nicely spread sound that will flatter any stereo system worthy of the name.

* * *

HITS OF THE 20"s. Orchestrated by Ray Terry, with Barbara Brown, Benny Lee, Jean Campbell and the Michael Sammes Singers. Stereo, World Record Light Music Club, LM 7012.

The noisy, rollicking spirit of the twenties has been resurrected quite effectively on the 12 tracks of this new disc. The orchestration follows the appropriate pattern and the singers have that carefree, boisterous attitude that suits hits of the day like "Red, Red Robin," "Ain't She Sweet," and "California Here I Come."

Not all the titles will be as familiar as these but it is nevertheless certain that the disc will stir the memories of those who can look back on the years in question.

As far as the recording is concerned, the sound you'll hear is first rate, with plenty to occupy both channels of your stereo system. What are we coming to? The "Black Bottom" in stereo!

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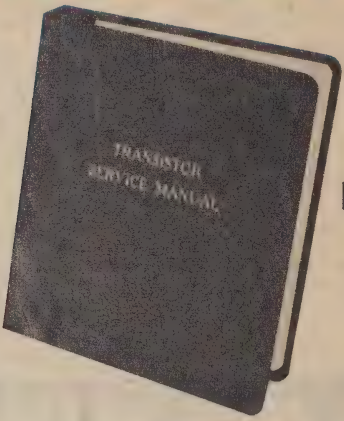

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IN REVIEW—By JULIAN RUSSELL

BEETHOVEN No. 3—"Unusual Performance"

Beethoven—Symphony No. 3 (Eroica) in E Flat Major, Op. 55. Vienna Philharmonic Orchestra conducted by Georg Solti. Decca Stereo 2165.

The Vienna Philharmonic's incomparable strings can be heard at their most glorious in this unusual performance that has many good features and as many questionable ones. Solti starts with a first movement so doggedly accented that after a few bars the listener finds himself waiting for an inevitable emphasis on the first beat.

But he goes on to a Funeral March in which human qualities are really enlarged to heroic proportions. Here is music fit for the greatest of tragic occasions, nobly grief-stricken yet never lugubrious, that expresses the sadness of those who remain, not that of the departed.

But Solti follows this with the daintiest Scherzo imaginable. The instruments skim over the top of the music like midges on the surface of a pond, moving with such nimble delicacy that no trace remains of their passage. It is a most impressive exhibition of sensitive precision, but I found it difficult to relate to the climate of the rest of the work.

And in this movement, the purist must school himself to accepting tempo changes that remove it still further from orthodox readings, and tolerate, in the Finale, some eccentrically slow statements and an over-emphasised final repetition of the main theme. The sound is good.

* * *

Beethoven—32 Variations in C Minor. 12 Variations in A Major (On a Russian Theme). 7 Variations in C Major (On "God Save the King"). Rondo a Capriccio in G Major, Op. 129 (Rage Over a Lost Penny). Sonata No. 22 in F Major, Op. 54. Gyorgy Cziffra, Pianist. HMV Mono ALP1717.

The unpredictable Cziffra is content here to allow the music to speak for itself without interposing himself between it and the listener. The most critical audience will find no reason to complain about any untimely exuberance or showy virtuosity for its own sake.

He tames his dazzling technique into becoming servitude without impairing its splendid vitality. And he adds to his readings a poetic quality that never degenerates into sentimentality.

I enjoyed most the 32 Variations in C Minor and the 12 Variations in A Major with their beautifully considered changes from sweetness to sturdiness, the musical thought always carried to its logical conclusion by a supervision that carefully preserves the work's organic whole.

To me, the Rondo a Capriccio would have been improved by the injection of some of the boisterous humour in which Beethoven sometimes indulged, both in his music and conduct. And a little of the delicate lyricism of the F Major Sonata is sacrificed by over-careful articulation of the octave triplets and an Allegretto that need not have been made to sound quite so formal.

However, the two sets of variations mentioned above should make the disc a valuable acquisition to any record library.

* * *

Beethoven—Violin Concerto in D Major, Op. 61. David Oistrakh and the French National Radio Orchestra conducted by Andre Cluytens, Columbia Stereo SAX-02315.

This is as fine a recorded performance as any available, yet not without its faults, chief of which is some occasional off-the-target intonation by the soloist and a passage here and there where the orchestra drags a little behind him. But the general grandeur of Oistrakh's conception makes these seem relatively unimportant.

Indeed Oistrakh can carry the average listener along with him so irresistibly that only the ungenerous will complain about such slight blemishes. And even the most carping of critics would be hard-pressed to find anything to disparage in his moving account of the slow movement. I know of no better in the whole literature of recorded music.

Except for the slight lapses referred to above, Cluytens supplies an exemplary accompaniment, reflecting the soloist's mood in every bar.

* * *

Mahler—Symphony No. 2 in C Minor (The Resurrection). New York Philharmonic Orchestra with Emilia Cundari (soprano), Maureen Forrester (contralto) and the Westminster Choir conducted by Bruno Walter. Coronet Stereo KLCS 2683/4.

You will need to be a staunch admirer of Mahler to find unqualified enjoyment in these two 12-inch discs, despite the in controvertible authority of Walter's interpretation, the superb playing of his orchestra, and engineering that does full justice, in its spaciousness and tonal richness, to both.

For here is the composer in one of his most solemnly orotund moods seeking to express in music his thoughts on life, death, and life after death with truly Germanic earnestness. And he places at the service of his philosophic speculations a gigantic orchestra with augmented brass and percussion together with an organ, choir and two female soloists.

He does not, of course, deploy all his extensive resources all the time and frequently produces sounds exquisite in their expressive sensitivity. But he develops most of his material at such length that only his most ardent disciples will hear the whole work through without a sense of tedium from time to time.

But I must confess that the splendour of Walter's performance made me feel slightly uncomfortable in the thought that I must be missing a grand experience in not sharing with him his love and admiration of the work.

* * *

Music of the World's Great Composers. Bach—Brandenburg Concerto, No. 1. Handel—Water Music Suite. Haydn—Symphony No. 94 (Surprise). Mozart—Symphony No. 40 in G Minor. Beethoven—Symphony No. 3 (Eroica). Rossini — Barber of Seville Overture. Schubert —Symphony No. 8 (Unfinished). Berlioz—Roman Carnival Overture. Mendelssohn—Symphony No. 4 (Italian). Chopin—Les Sylphides Excerpts. Schumann — Symphony No. 3 (Rhenish). Liszt—Mephisto Waltz. Wagner—Prelude and Liebestod from Tristan and Isolde. Verdi —La Forza del Destino Overture. Franck—Symphony in D Minor. Johann Strauss Jnr. — Waltzes. Brahms—Symphony No. 3 in F Major. Bizet—Prelude to Act 1, Carmen. Tchaikowsky — Symphony No. 6 (Pathetique). Dvorak — Carnival Overture. Grieg — Peer Gynt Suite No. 1. Rimsky-Korsakoff —Russian Easter Overture. Debussy —Prelude a L'Apres-midi d'un Faune. Richard Strauss—Till Eulenspiegl's Merry Pranks. Sibelius — Finlandia and The Swan of Tuonela. Stravinsky—The Rite of Spring. **12 12-inch Stereos. RCA — Readers Digest.**

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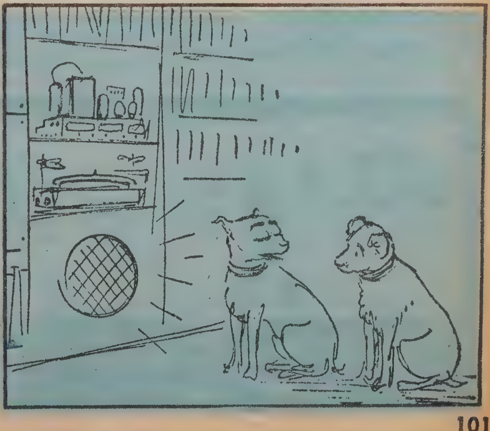

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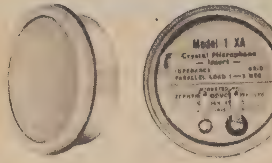

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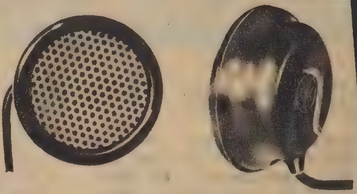

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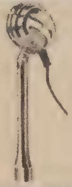

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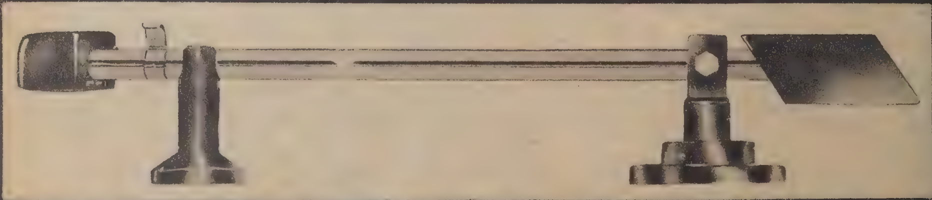

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The price of this album will make it a tempting bargain for those starting to build a record library. It sells at £17/5/, and there is nothing about the production that has been scamped to make it available at such a low figure.

Each composer is represented by a typical—and deservedly popular—work, and an accompanying booklet supplies useful information about the contents. Though no performance could be included in the "star" class, all are extremely competent and a few excellent.

Some of the orchestras bear names that suggest hidden identities, others will be better known to regular record buyers. And conductors Sir Adrian Boult, Oivin Fjelsted and Rene Liebowitz need no introduction.

The stereo sound might best be described as serviceable—and variable, though here again some of it is of far better quality than might have been expected at the exceptionally low price. The only snag is that the set must be bought as a unit so that those already embarked on the establishment of a record library will find some duplication inevitable.

No reasonable buyer would expect to find world-beating performances in such a collection, but even the most discriminating is unlikely to be dissatisfied at what is included at this price range. Preferable performances for experienced listeners can only be acquired at a much higher price.

A special booklet has been compiled for the use of teachers, setting out the structure of the works with simple explanations of their form. And there is nothing about the get-up of the whole production to hint at penny-pinching economy.

I can envisage no better way of laying the foundations of a well-stocked, representative record library.

* * *

Schubert — String Quartet No. 14 in D Minor (Death and the Maiden). Hollywood String Quartet. Record Society 16/6016.

An admirable performance characterised by immaculate precision of attack, splended rapport between the players, and unwaveringly accurate intonation in a piece where the greatest string quartets are sometimes at fault. The sound, too, is eminently faithful if the disc is played on stereo equipment.

Most of the time the Hollywood's tone is cleanly expressive rather than sensuous though there is never any hint of the modern tendency to over-cool, cerebral statement. I know of no better recording available at present and the issue of anything as good at the same price — 39/6 — seems unlikely in the near future.

* * *

Hans Hotter (bass-baritone) Lieder Recital of Songs by Schubert, Strauss, Schumann, Wolf and Loewe. Record Society 17/6017.

Hotter offers some delightful lieder singing in this well-built recital. And it would be difficult to imagine more faithful engineering.

Schubert is represented by "Im Fruhling," "Der Lindenbaum," "Sie Mir Gegrusst," "Wanderers Nachtlied," and "Geheimes," Schumann by "The Two Grenadiers" and "Mondnacht."

Richard Strauss appears twice, in "Ach, Weh Mir Ungluckhaften Mann," and "Ich Trage Meine Minne," as does Wolf, in "Nimmersatte Liebe" and "Anakreons Grab."

The Loewe ballad "Edward" will be known to most listeners, but I doubt if many will have heard his "Erlking" before. This is quite different from Schubert's famous setting of the same text but misses nothing of the drama of its better-known rival. Indeed no less a critic than Richard Wagner expressed the opinion that Loewe's setting was more dramatically truthful than Schubert's.

To support him throughout this enjoyable recital Hotter has the benefit of the services of that incomparable accompanist Gerald Moore. An additional feature for recommendation is the excellently set-out text of each song which combines much useful information in a brief annotation.

* * *

Tchaikowsky — Violin Concerto in D Major, Op. 35. Saints-Saens —Introduction and Rondo Capriccioso, Op. 28. Michael Rabin and the Philharmonia Orchestra conducted by Alceo Galliera. World Record Club TE236.

Both are showy performances by a very brilliant young violinist, but for my taste, a trifle too overcharged emotionally. And Rabin's closeness to the mike sometimes makes his tone sound a little raw.

The same "presence" also puts an unwanted edge on the Philharmonia's usually lovely tone. It all sounds a trifle too clear, though the definition, for the same reason, is excellent. And the same reason provides a close-up of Rabin's formidable technique without, however, any distraction of the listener's attention by fingerboard thump.

The accompaniment under Galliera is consistently good and if you do not object to the soloist's super-elastic rallentandos and accelerandos, this is a good buy in the cheaper price bracket.

* * *

Music of the King's Masters. Bliss—Checkmate Ballet Music. Handel—Water Music Suite. Purcell —Airs and Dances. Sinfonia of Bliss, Master of the Queen's Musick. World Record Club TW111.

Bliss, the current Master of the Queen's Musick, may be thought by some to figure a little disadvantageously here in the company of two such mighty forerunners. But neither appears in his most impressive form, but only in arrangements, while the Bliss work is given in its original form.

Despite the claim in the sleeve notes that the Handel pieces are "given in their original instrumentation," the orchestra used here would have surprised the old gentleman no end. It was customary in his days to use as many oboes, whenever possible, as violins. In fact, in many of his scores, the only clue to the absence of oboes is the marking "senza oboi," otherwise their presence was taken for granted.

In this recording, the strings predomi-

(Continued on Page 107)

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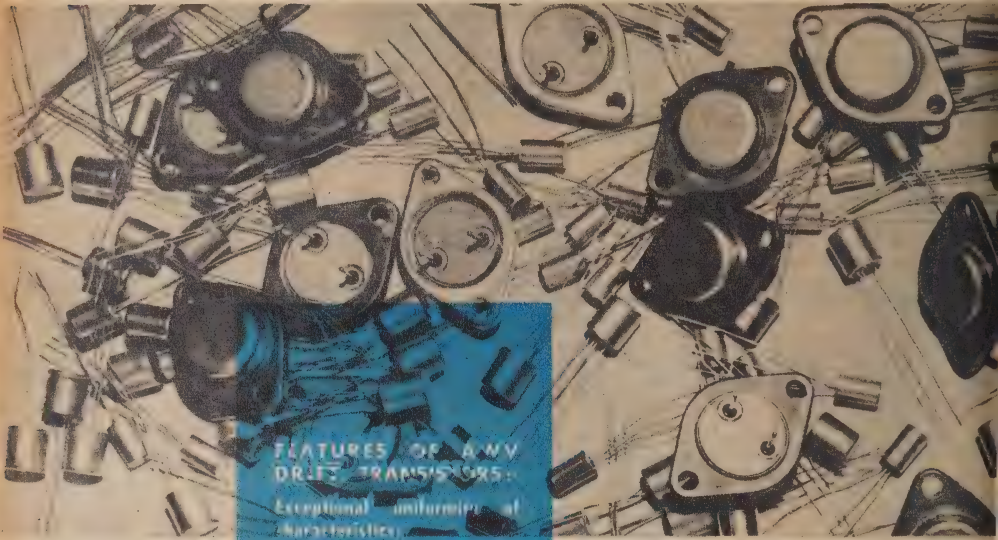

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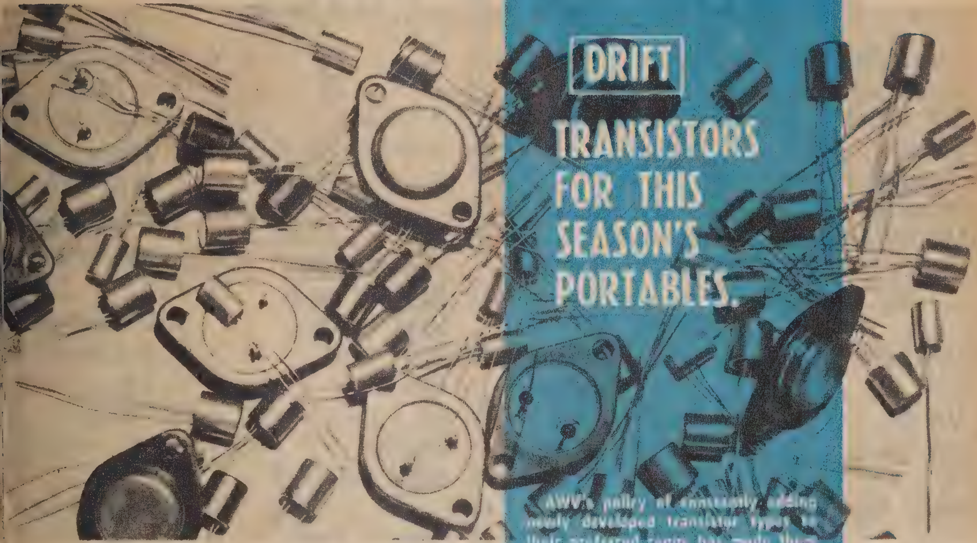

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(Continued from Page 103)

nate in a quite un-Handelian manner, though the general brightness of the orchestration with its continuing emphasis on primary colours, establishes an atmosphere much more suggestive of the 18th century than the Harty arrangement that is nowadays so often used.

The playing is consistently expert in all departments, with a special word of praise for the brass. The arrangement is, by the way, by Bliss.

Less successful are the Purcell pieces, taken from the operas "The Gordian Knot Untied," "Amphitryon," "Distressed Innocence" and "The Married Beau." Here, the thickness of the texture is far removed from that of the original sound, though the unfamiliarity of the items may tempt Purcell lovers to overlook this fact in their eagerness to hear "new" works by this most felicitous of composers.

Bliss' own suite is first-rate ballet music, illustrative of stage action in which the dancers play the roles of pieces on a giant chessboard. It is all very tuneful and full of pleasing rhythmic surprises, though Bliss seems satisfied with a rather more reticent response from the orchestra in his own composition than that he wins in the Handel and Purcell suites.

The sound is efficient, though not outstanding.

RECOMMENDED

Mozart—Quintet for Clarinet and Strings (K. 581). Reginald Kell and the Fine Arts Quartet. Concert-Disc Stereo CS203/22. Art of Fritz Kriesler. Short pieces, all of them arrangements. RCA Camden 46. Mono.

Kathleen Ferrier—A Broadcast Recital, given on June 5, 1952. English songs. Decca 10-inch Mono LWA5353.

Chopin—Piano Concerto No. 1 in E Minor. Geza Enda and the Philharmonia Orchestra under Alceo Galliera. Columbia 10-inch Mono. 33C1057.

J. S. Bach—Brandenburg Concertos. Karl Munchinger and the Stuttgart Chamber Orchestra. Ace of Clubs Mono ACLA-1/69. Schubert "Great" C Major Symphony. Josef Krips and the Concertgebouw Orchestra. Ace of Clubs Mono ACLA-70.

Maria Callas sings Puccini. Arias from Manon Lescaut, Madam Butterfly, La Boheme, Suor Angelica, Gianni Schicchi and Turandot. With the Philharmonia Orchestra conducted by Serafin. World Record Club Mono TE235.

Vivaldi—The Four Seasons. Op. 8. Stuttgart Chamber Orchestra conducted by Karl Munchinger. Ace of Clubs Mono ACLA91.

Suppe—Overtures. Light Cavalry, Poet and Peasant, Morning Noon and Night in Vienna, and Pique Dame. The Vienna Philharmonia Orchestra conducted by Georg Solti. Decca Stereo SXL2174.

Beethoven—String Quartets in D. Major and C Minor, Op. 18, Nos. 3 and 4. Fine Arts Quartet. Concert-Disc Stereo CS 210/25.

Helen Traubel in Opera and Song. RCA Camden CAM51. Mono.

Prokofieff—Chout. Suite from the Ballet (The Buffoons). London Symphony Orchestra conducted by Walter Susskind. Top Rank Mono 35/012.

* * *

Festival Casals de Puerto Rico, 1959. Haydn—Symphony No. 45 in F Sharp Minor (Farewell). Mozart—Symphony No. 36 in C Major (K.425) (Linz). Festival Casals Orchestra of Puerto Rico conducted by Pablo Casals. Coronet Stereo KLCS2729. Mono KLC2729.

The sound on the Haydn side in both the mono and stereo versions is strangely dry, a fact that becomes all the more surprising when one learns that it was recorded at a live session in a concert hall complete with audience. On the reverse it is a little freer, but still a little unresonant in terms of the best of modern engineering.

Casals presents the first movement of the Haydn with authority and energy surprising in a man of his advanced years, especially one who only recently recovered from a serious heart attack. But he follows this with an Adagio of the utmost tenderness and tranquility.

After a fine sturdy Minuet, Casals returns in the Finale to the robust atmosphere of the first movement, pushing his strings along with great energy.

The Mozart receives much the same treatment, the fast movements exploiting the music's vigour rather than its daintiness without any concessions to 18th-century prettification. But in the last three movements of this symphony some listeners may be distracted by the extraordinary series of animal - like grunts with which the conductor encourages his orchestra.

Mozart—Serenade No. 11 in A Flat Major (K.375) for 2 Oboes, 2 Clarinets, 2 Bassoons and 2 Horns.

Serenade No. 12 in C Minor (K.388) for 2 Oboes, 2 Clarinets, 2 Bassoons and 2 Horns.

Initial Version of second Minuet and 2 Trios to Serenade No. 11 in E Flat major. London Baroque Ensemble, conducted by Karl Haas. Pye Mono CCL30119.

This is a connoisseur's disc, offering an aristocratic performance of music one is seldom lucky enough to hear in a concert hall. And the tangy quality of the wind instruments will provide a refreshing change for ears jaded by more regular combinations.

The first thing to strike even the most critical audience will be the beautiful attack and release of the players, which fails in knife-edged precision only once or twice during the long recital. To this listener these tiny blemishes served only to advertise the fact that the players were human beings and, for that reason, comfortingly fallible.

The mono sound, played on stereo equipment, is always in exquisite balance and the tone of the instruments, in both solos and combination, admirably faithful. And the works are as entrancing as any Mozart ever wrote. Highly recommended.

* * *

Beethoven—Symphony No. 4 in B Flat Major, Op. 60. Symphony No. 5 in C Minor, Op. 67. Played by the Columbia Symphony Orchestra, conducted by Bruno Walter. Coronet Mono KLCS2688.

Beethoven—Symphony No. 4 in B Flat Major, Op. 60. Overture,

(Continued on Page 123)

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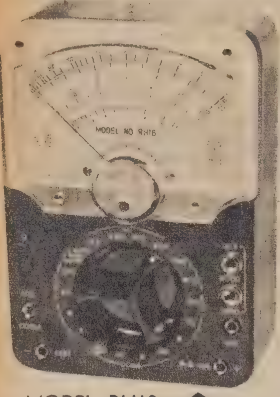

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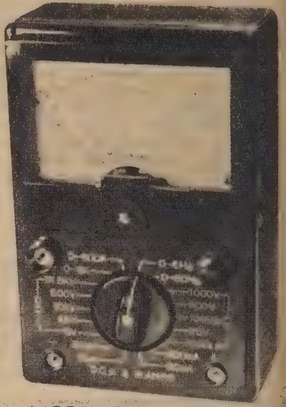

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AMATEUR BANDS WITH BILL MOORE

SPACE PROJECT FOR AMATEURS

A date with space for radio amateurs appears likely to be made in 1961. Negotiations are being carried out for the orbiting of a satellite carrying amateur VHF equipment. Amateurs around the globe will provide valuable data on signals from their own satellite.

POSSIBLY the most important project yet proposed for Radio Amateur participation is currently being planned on the West Coast of U.S.A. It is project OSCAR—Orbital Satellite Carrying Amateur Radio—organised as a long-range program to arouse amateur interest and participation in space communication. It was born following an article in CQ Magazine by Don Stoner, W6TNS, who suggested that amateurs were being left out of space exploration and should build their own satellite "if only someone had a missile."

PROJECT OSCAR

From these original ideas amateurs on the West Coast banded together to form what was to become the Project OSCAR Association. It comprises essentially amateurs from five Radio Clubs affiliated with manufacturing concerns and representatives from other services. Many of the amateurs are directly associated with various aspects of the satellite projects being carried on.

Bill Orr, W6SAI, known to amateurs throughout the world, is in charge of publicity for OSCAR. Various electronic component manufacturers have donated enough parts to permit building the beacon at no cost to the association.

According to the association chairman, Fred Hicks, W6EJU, radio amateurs have a date with space in 1961.

It is anticipated that the first amateur satellite will carry a 100 milliwatt transistorised beacon.

It would operate in the internationally assigned portion of the 144 mc/s band. Negotiations at the time of writing are being carried out for the packaging of the amateur equipment within an existing space project and it is hoped approval will be granted.

INTO SPACE AGE

Such an operation would put amateur radio right into the middle of the space age and would create tremendous interest among amateurs throughout the world.

It is considered the Project OSCAR should be undertaken in at least two stages, the first one could be carried out in a short space of time with existing equipment. Amateurs working on the various space programs would design and build a low power transmitter weighing between one and two pounds, transistor operated and powered by batteries or solar cells with an operating frequency close to 144 mc/s.

The beacon transmitter would be keyed continuously with some form of identifying signal. This amateur satellite could be fired "piggy back" on some future space shot. The technique of adding instruments to existing space craft is commonly used now and it is possible to use the "piggy back" method for orbiting several objects from a single injection vehicle.

Phase two could mean the orbiting of a satellite containing a relay or repeating type of amateur station. The device could be activated by signals transmitted within the 144 to 145 mc/s portion of the band.

After amplification and demodulation the received signal could be used to modulate a transmitter in the 147-148 mc/s segment of the band. Messages originating on one coast of the U.S. could be relayed to the midwest if the satellite was at an altitude of 400 miles. Tape equipment for delayed repeating could be incorporated. It would be a thrill to hear the words of an amateur in South Africa or the U.S. which had been recorded on the satellite minutes earlier.

Choice of the 144 mc/s band for this work was not made at random. Performance can be easily predicted on the basis of information gleaned from the 108 mc/s equipment used on the U.S satellites. The 10 and 20 milliwatt transmitter signals from the Vanguard and Explorer were readily received by amateurs using dipoles and often makeshift converters. The tracking of a 144 mc/s satellite with specialised band equipment and antenna arrays would be an easy job.

WORLDWIDE CHECK

Amateurs throughout the world could co-operate by monitoring the satellite's signal and submitting the information obtained to the ARRL who would co-ordinate such data. The selection of the 144 mc/s band would allow amateurs in Zone 1 and 3 to participate and would also cover amateurs in portion of Zone 2. In the U.S. alone it is estimated that at least 10,000 of the 200,000 amateurs are active on 144 mc/s. Many hundreds of amateurs also use the band in countries scattered around the world.

The project also incorporates the plan for the construction of OSCAR beacons to be constructed as club and individual projects for installation on mountaintops or carried by balloons and planes to check the range of receiving equipment. Such a scheme would also provide training that should be helpful in observations of the OSCAR satellite at a later date.

(Continued on Page 111)

N.S.W. CIVIL DEFENCE EXERCISE

ON Saturday, February 18, the Civil Defence Organisation in N.S.W. conducted "Operation Picnic," an exercise to check aspects of a mass evacuation of Sydney in event of an atomic attack. Four convoys of cars carrying some 700 persons moved from different locations in Sydney west to the Blue Mountains. The convoys moved on strict time schedule with a half hour between groups. Their first stopping place was some 40 miles west of Sydney at Glenbrook Park, which was called the Welfare Assembly Area, where they were checked for radio-active contamination and provided with tea and biscuits. Displays were given of decontamination methods and first aid. From there the convoys moved to the Welfare Centre at the Katoomba Showground, a further 18 miles westward. At this centre, medical, child minding, rest, and other facilities were provided and lunch served.

The operation received considerable publicity via radio, Press and TV. At Katoomba, the assembly was addressed by Major-General Ivan Dougherty, Director of Civil Defence in N.S.W.

Radio amateurs provided a communications net over the whole of the Blue Mountains area during the operation. Wicen comprised 144 mc/s mobile stations of the Blue Mountains and VHF/TV sections of the N.S.W. division. All stations operated mobile except the Blue Mountains Sections Base Transmitter, VK2AUX, which was located as control at the Katoomba Showground.

The progress of the convoys on their journey over the mountains was reported to the two assembly points by amateur mobile stations located at vantage points.

Over 20 amateurs participated in the exercise and mobile stations were provided by Phil, VK2ZBX, at Emu Plains, Wal, VK2MZ, and Horry, VK2HL Glenbrook, Bob, VK2ASZ Linden, Paul, VK2ZPJ Wentworth Falls, Dick, VK2ZCF Katoomba. The base station, VK2AUX, was operated by Dave, VK2NK, and Norm, VK2QA, who, on receiving positional information, announced over the P.A. the progress of the convoys to those assembled at the showground.

The amateur net worked very effectively despite the rather difficult terrain for VHF signal propagation. The arrangements for the operation were in the hands of the Blue Mountains Civil Defence Organisation. Tribute was paid in the Press to the work of the radio amateurs as key men in the practice evacuation. Colonel Strachan, chief of the B.M.s C.D.O., stated, "The smooth running of the convoys was largely due to these men who were stationed at points from Emu Plains to Katoomba and kept the Civil Defence Organisation informed on all movements. They are to be congratulated on their splendid work."

The operation was the first of its kind held in Australia and provided valuable information and practice for assisting groups.

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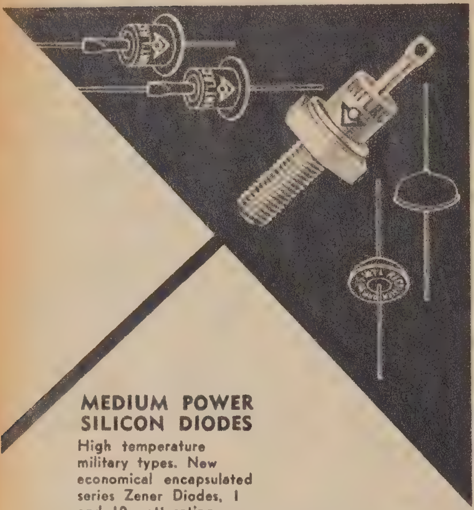

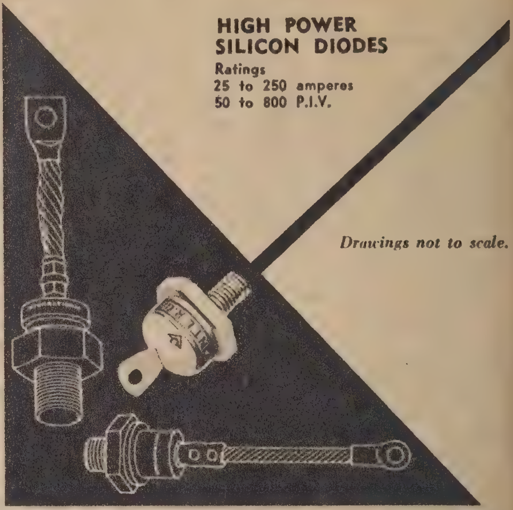

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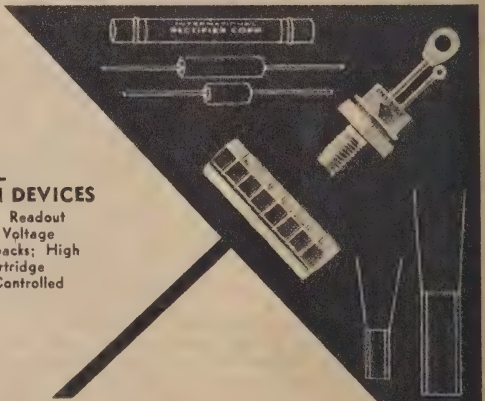

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Many U.S. West Coast amateurs have been working hard to ensure the success of the scheme. Full publicity will be provided via the ARRL and other amateur societies. Suitable QSL cards are being prepared for issuance to amateurs who report on the satellite's signals.

Certificates will be presented to amateurs who provide outstanding service to the OSCAR project. The scheme provides amateurs with another absorbing interest and by virtue of their geographical location they can provide much valuable information on the orbits of their own satellite.

50mc BAND

THE previous announcement from the P.M.G.'s Department that the 50 mc/s had been granted for amateur use for an indefinite period was varied in February. It was then stated that permission had been granted for the band to be used until December, 1961, with a proviso. If the whole or portion of the band was required for the TV service before that date, 14 days' notice would be given to amateurs. Amateurs will have noted the allocation of channels for the stations to be located in country areas in all States announced in the Press in the same month.

Channel 1 has been allocated for two National stations. One is at Mt Canoblas near Orange, N.S.W. Changes have been made with channel frequency limits and include the introduction of Channel 5A IN SOME AREAS. The impact, if any, on amateur bands of these changes has not as yet been announced.

TO ELIMINATE QRM

A SCHEME to eliminate much of the QRM encountered between elephony stations on the amateur bands s being fostered in the U.S. Propo-ients for the arrangement point out hat it is the hetrodyne whistle, creeches and monkey chatter that reak up many contacts. If these facors could be eliminated, operators vould have comparatively clear condiions in the bands.

A number of conversations can be arried out in a crowded room simulaneously; by concentrating on the deired voice the ear can reject most if ot all of the other conversations.

A 4 kc/s separation between carers and SSB reference frequencies vould put the hetrodyne above the and-pass of most modern receivers. 24 .M. or 49 upper and lower SSB SO's could be theoretically carried ut per 100 kc/s of band width under e above conditions. Spot frequency peration for telephony stations is sugested with frequencies ending in 03, 07 nd at 4 kc/s intervals to 95, 99 and o on.

If all the spots on any band are ccupied at any given stage, one could ot operate without causing some interrence, but the selection of the freuency on which distant stations are perating would minimise it. At least o serious hetrodynes would be introuced.

Suggestions have been made that e scheme be tried with the golden le: "QRM others as they would RM you" — without hetrodynes and e like.

The arrangement is sponsored with e idea of more effective utilisation of the available amateur bands. It has been the subject of study by technically proficient amateurs and has been explained in articles by Dana Griffin, W2AOE in Q.S.T. Technically, there are problems; with ideal equipment there would not be many worries, but with some of the equipment in use today the scheme could only be partially effective.

THE WIA IN N.S.W.

THE February nocturnal fox hunt of the N.S.W. VHF and TV group saw a number of hounds wandering around the various Sydney suburbs looking for Barry VK2ZAH who was located near his home QTH. He was found by Pane, VK2ZPJ, and in second place arrived Neville, VK2ZNM. At the conclusion of the event, Barry and his XYL entertained the varied hounds and provided supper.

Lecturers at N.S.W. Division WIA meetings in February were Harold Burtoft, VK2AAH, and Mr Frank Cook of the Ionospheric Prediction Service. Harold lectured on antennas and associated equipment at the mid-month meeting held at the Administrative Headquarters. Harold's lectures on this subject are well known and of great interest and value to amateurs. Mr Cook lectured at the general meeting held at Science House and in a two-hour discourse covered predictions and propagation on all portions of the radio spectrum from "whistlers" at the VLFs to VHF signals.

Mr Cook for some months now has been providing special disturbance forecasts broadcast each Sunday morning on VK2WI. The lecture was of importance to the many amateurs attending. Overseas visitors at the meeting included Howard, WA6OMF, and two Johns, FK8AV and FK8AL. Members attending voted in favour of a notice of motion that in the use of FSK in all amateur bands the decision will be forwarded to the Federal Executive for consideration if necessary by other divisions.

Lecturer at the March meeting of the N.S.W. VHF and TV group was Bill Cox, VK2ZAC, who described and discussed design aspect of a well-known VHF commercial transmitter and associated equipment. Bill covered, too, other phases of VHF operation, including the unusual in VHF antennas.

INTEREST IN WICEN

A PROBLEM encountered here in Australia is in maintaining interest in nets such as WICEN between the various national emergencies that arise. To hold interest with many years between disasters is a job for only the really dedicated amateurs—those generally who in past years have worked under emergency conditions. Simulated exercises provide some interest but it is only the real thing that creates true activity.

Fortunately here in Australia we are blessed with reasonable weather, and it is nearly six years since amateurs were active on a wide-scale operation. Conditions change, too, between disasters, more Service and governmental nets are established in likely areas and the

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role the amateurs must play in such circumstances can be greatly varied. Many stations have been established by the authorities in areas of N.S.W. likely to suffer severe flooding, and perhaps the work to be taken by the amateur in the future will be in local communication rather than with VK2WI in Sydney as in the past. Each emergency brings its own problems and the radio amateur on the spot will solve them to the best of his ability—he has done a good job in the disasters on record.

Most Australian amateurs envisage that with the severe climatic conditions experienced in the U.S. that the amateur emergency nets over there would be fully organised and often operative. A review of the report on amateur activity during the "Donna" hurricane of 1960 that swept up the east coast of the U.S. revealed that each such emergency provides a refresher course in net operation, net discipline, and traffic handling and many new lessons are learnt. NEC and RACES nets re-establish contact with the authorities and discussions were held for improvements in operations in the future. But, as here, "the lull between the storms" is too long and many of the lessons learnt are forgotten with changing personnel and time. Amateurs can and will be prepared up to a certain pitch but only the actual disaster, not simulated emergencies, can provide the occasion that is to test their operating ability to the full.

IT is with regret the passing of Harold Peterson, VK2HP, of Coogee was recorded on February 16 at the age of 73 years. A past-president of the N.S.W. Division of the W.I.A., he was well known to N.S.W. amateurs. Harold was first active in the late 20s and was an office-bearer in the Waverley Radio Club for many years. He held executive positions in the N.S.W. Division from 1936 to 1946, president in 1937 and 1938. Active mainly on the 14 Mcs band with telephony, he worked considerable DX when the band was first opened. Harold retired from the Sydney Water Board in 1952 and for some years was active on all bands. The sympathy of all amateurs is extended to his family.

"PIRATE" FINED

THE headlines — "Ham" Fined — in Sydney newspapers caused some ritical opinions to be expressed on reporting by amateurs. It was actually he story of a "pirate" having been apprehended by P.M.G. inspectors for perating without a licence on amateur ands. The statement following was uite clear and at least Ham was in nverted commas, which added up to a etter Press than we had received on revious occasions. It is interesting to ote that despite efforts at various levels we are destined to be known as "Hams," ot radio amateurs, as many would refer. The corruption is practically niversally accepted and it appears as f the title will never be changed.

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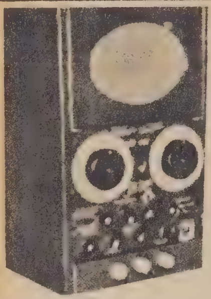

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1625	£1	1M5	5/

ROLA NEW 7x5 SPEAKERS

£1-9-6

12in £2/7/6

Post, N.S.W., 3/6: Interstate 6/.

NEW C.R.O. TUBES

3AP1-906	£1/7/6
5BP1	£1/17/6
CV1957	9/6
CV112	10/
VCR138	17/6
VCR97	£1 17/6
5FP7	17/6
CV322	7/6
VCR511B	£1/7/6

NEW POWER TRANSFORMERS

240v A.C. 50 cycle primaries. Standard 6.3 filaments.

300 x 300v 40mA	19/6
1960 5" CRO	£5/10/
1960 3" CRO	£3/15/
60mA 385 x 385 vert.	£1/2/6
325 x 325v 150mA	£3/17/6
250 x 250v 180mA	£3/17/6
295 x 295 300mA TV	£6/15/
115v 700mA TV	£4/17/6
750 x 750v 750mA	£7/10/
240v to 6v or 12v 1 amp	12/6

TV TRANSFORMERS

275 x 275V 350 mA	£2/15/-
180V Double 700 mA	£2/5/-

Vibrator Power Transformers

6V 135V 35mA	£0 19 6
6V 300V 125mA	£3 17 6
12V 325V 125mA	£3 17 6

Inverter Transformers

6V 240V 40 Watt	£3 7 6
12V 240V 60 Watt	£3 7 6
32V 240V 60 Watt	£3 7 6
12V 240V 100 Watt	£4 5 0
32V 240V 100 Watt	£4 5 0

RELAYS

6V, 3-pole Miniature	15/
1700 SPDT	7/6
1300 SPDT	7/6
500 x 500 SPDT	7/6
12 volts DPDT, 5 amp	£1
12 volts DPDT	12/6
100pf TX var. condensers	10/
100 to 500pf 3000v. var.	10/
500 to 2500pf 750v. var.	10/
Hi-speed Polarised relay	£2/10/
400 ohm	12/6
6V Type 3000 DP, DT	7/6

Hi-lo Phono Transformers	4/6
Hi-voltage, Lead-thru Insulators each: 15/ doz.	1/6
Multi-strand 4-core Cable, yard	1/
60pf with Vernier	£1/1/
30 pf	10/
Throat mikes, new	3/6

OIL FILLED CONDENSERS

.5mfd 600V	3/6
2mfd 600V	6/6
1mfd 600V	6/6
4mfd 600V	6/6
4mfd 2.5K	£1/10/
2mfd 2K	15/
.5mfd 5K .1 5K, .1 3K AC .25 4K	15/ ea.

SOUND-POWERED

HEAD & BREAST SETS

Used, tested. No batteries required.

12/6

Post 3/6.

GENEMOTORS

Input	Output			
12v.	600v.	300mA	New	£5 10 0
24v.	250v.	100mA		£1 0 0
24v.	550v.	375mA		£2 0 0
24v.	250v.	60mA		£1 5 0
12v.	500v.	350mA		£8 10 0
12v.	1200v.	200mA		£6 10 0
24v.	250v.	100mA.	New	£2 0 0
12v.	235v.	50mA		£2 15 0
12v.	350v.	50mA		£2 15 0
24v.	540v.	200mA	New	£2 15 0
24.v	300v.	250mA	New	£2 15 0
12v.	275v.	110mA		£3 15 0
12v.	300v.	250mA	New	£2/15/

New Vacuum Pumps

27lb pressure. 7 cu. ft per minute.

£2/17/6 Post 7/6

GENEMOTOR SPECIAL

28-32v. 300v. 250mA. Will operate TV sets.

£1-7-6

New Coils and Intermediates

Standard or miniature to suit all valves

Coils B/C, 455 KC	9/6
Coils S/W, 455 KC	9/6
Inters	11/6
Slug tuned H.F. coils to suit 44 megs.	4/6

NEW

GENEMOTORS

12V. Input, 600V. 250mA output.

£5/10/-

WANTED

Communications Receivers. Test equipment, P.A. Gear. Large or Small surplus stock. Best prices. Call, write or phone any time.

DYNAMIC HEADPHONES

Low impedance **17/6**

Postage 2/6.

Dynamic microphones, type 7. 12/6

Postage 2/.

BLOWER MOTORS 24V

New American Miniature Units. Will operate as low as 6V.

£2/10/-

Postage 4/6.

P.A. SPEAKER UNITS

P.A.7. New condition

£7/10/- EA.

Short horn enclosure for same. £1 extra

NEW INDICATOR UNITS

For THAT C.R.O. 10 Volts. VCR97. 6in Tube with mumetal shield and socket. In Cabinet.

£7/15/-

Used units as above. These are complete with valves. But were rack mounted and do not have covers.

£3/15/-

NEW ROTARY CONVERTERS

160 watt. 50 Cycle. 24v to 32v input. Output can be supplied for 50-110 or 240v as required. Suit radiograms, TV, tape recorders, fluorescent lights.

£19/17/6

P.A. SPEAKERS

10in Rola in 18in x 12in x 8in enclosures. With 600 ohm transformers and stepped attenuators.

£2/10/-

COMMUNICATIONS RECEIVERS

American, National, H.R.O. Air Tested, Perfect Order. 6 Coil Boxes to 30 Megs. Crystal Gate, S. Meter, 2 R.F., 2 I.F. 240V AC.

£75

AMR 101

A.W.A. Version of Above Set. Similar Circuit and Facilities to 25 Megs.

£65

NEW MARCONI G100

6 Band 40 Kc to 30 megs. 10 valve. 2 RF 21-F stage, 240 A.C. Fully Band spread. Air Tested.

£65

240V A.C.

TYPE S POWER SUPPLIES

As used for AR8-AT5 Stations 575V 350mA plus 250V, 100mA Plus 12V DC 10amp.

£16/17/6

522 TRANSCEIVERS

Complete with Valves. Excellent Condition.

£8/17/6

522 Receivers. Complete with Valves	£4/17/6
522 Transmitters. Complete with Valves	£5/17/6

LIGHTING PLANTS

12v. 300 watt. Direct coupled to 1 h.p. petrol engine. Tested. Perfect order.

£36/10/-

115v D.C. 2½ amp. As above. New. £29/10/.

AIRCRAFT GENERATORS

24V. 50AMP £5/15/
28V. 100AMP. £12/17/6.
28V. 60AMP. £10/10/-.

1154 TRANSMITTERS

100 watt output. Complete with Valves and meters. £4/17/6.

AT5 TRANSMITTERS

Complete with Valves. £5/17/6.

NEW POTENTIOMETERS

2 meg. 1 meg. ¼ meg. Linear. Tab., Pots.,

2/- ea. 21/- doz.

DUAL CONCENTRIC

1 meg plus 200K plus DPST switch.
1 meg plus 2K standard spindles.

7/6 ea. £4/-/- doz.

A
Amplification
C
Communication
E
Electronics

RADIO

PHONE LA 3845

136 VICTORIA R'D. MARRICKVILLE, SYDNEY, N·S·W

636 KING STREET NEWTOWN-LA7008

WIDE BAND OSCILLOSCOPE

5 meg. band width. Calibrated high gain. Frequency compensated Y Amplifier 8 Position .05 to 600 volts. Push pull vertical and horizontal deflection. Hard time base. 20 cycle to 75 Kc. Latest American R.C.A. circuitry, complete with probe.

3in £49/17/6 5in £55/15/-

SINGLE UNIT STEREO-AMPLIFIER

4 WATTS PER CHANNEL.
Featuring Bass and Treble boost frequency response.
20 to 20,000 cycles.
High quality Ferguson O.P. transformers with multi match secondaries.
LATEST CIRCUITRY. SELENIUM CONTACT RECTIFIERS.

£26/17/6

PLAYMASTER No. 2
7 WATTS PER CHANNEL, Dual Push Pull, Ultra Linear Output KIT SET £37/10/-. Wired and Tested £4/10/- extra.
Speakers to suit from £3/-/- per pair. Cabinet chassis, front panel and anodised plate only £4/5/-.

R. TV & H 110 DEGREE 21in

TV KITSET

With latest fringe area tuner and 4 stage aligned and tested strip. Complete kit including picture tube.
Also Masks and Straps.

£96

Wired and Tested £12 extra

Control Panel for side and top front mounting £1 extra.

Battery Chargers

To charge 6 and 12-volt, 3 amp. **£5/15/-**
6 and 12v, 4 amp.
£6/15/-
Other Ratings To Order.

10 VALVE, 6BA6, 6AN7, 6N8, 12AT7, EM80, 2 x EF86, 2 x EL84, 5V4.
2 Rola 8MX Speakers.
£49/15/-

Send for full details on Radiogram Chassis, TV and Amplifiers.

15 VALVE, 2 x 6BA6, 6AN7, 6AV6, 6BR5, 2 x EF86, 12AT7, 2 x 12AX7, 4 x EL84, 5AS4.
4 Jensen Speakers.
£66/15/-

STEREOGRAM CHASSIS

Dual Wave with RF Stage.
8 VALVE, 6BA6, 6AN7, 6N8, EM80, 12AT7, 6BM8, 6BM8 5Y3.
2 Rola 8MX Speakers.
£38/15/-

CORDLESS STEREOGRAM

11 transistors. Tuner with R.F. Stage. 1 watt per channel.
2 7x 5 Speakers,
2-tone cabinet.
£51/15/-

21in PICTURE TUBES

FACTORY FRESH GUARANTEED.
90 or 110 degree.
£19/15/-
Other sizes as required.
Trade in your DUD tube £2/-/- allowed if glass not damaged.
21in Masks, 110 degree 10/-.

A.C.E. PORTOTAPE RECORDER

Twin Track 3¾in Per Second.
2 hour play on L.P. tape.
Frequency response 60 to 10.000 C.P.S. Inputs for mike. Pickup radio output. For extension speaker. Also to HI I.M.P. Complete with Crystal mike tape spools, etc.
Weight 22lbs.

£51/15/-

RADIOCORDER
Also available with built-in Tuner.
Weight 25lbs.

£65

MINIATURE P.A. AMPLIFIER

15 Watt output extended frequency Ferguson Multimatch Voice Coil. O.P. transformer inputs for crystal mike and pickup with separate mixing gain controls. P.P. EL84 — 6BQ5 output fitted with accessory socket.
Dimensions 12in x 8in x 4½in. fitted in Playmaster 2 Cabinet.

£17/15/-
240V A.C. operation.
240V A.C. and 12V D.C.
£22/17/6

AMPLIFIERS

Public Address Range
240v-AC

6 Valve, 10 watt,	£14/17/6
6 Valve, 25 watt,	£25/17/6
6 Valve, 40 watt,	£32/7/6
7 Valve, 20 watt,	£22/17/6
6-valve, 50 watt	£34/17/6
100-watt	£63

Battery Operation

6 valve 6v, 10 w	£18/15/
7 valve, 12v. 12 watt,	£19/15/
7 valve, 12v. 25 watt,	£24/17/6

BATTERY-AC OPERATION

6 valve 6 x 240 10 watt, £20/15/-.
7 valve 12 x 240 12 watt, £21/15/-.
7 valve 12 x 240 25 watt, £29/7/6.

TV ANTENNAE

A Complete Range from
£4/15/-

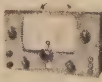
TAPE DECKS

B.S.R. Monardeck
Twin Track 3¾in as used in R. TV and H. Tape Recorder a very efficient and reliable unit. With excellent performance.

£21

Chassis and Cabinet available to suit. Motek English 3-speed Twin Track Push Button Unit with counter position locator. Recommended for Mullard circuit.

£27/17/6



LEADER Signal Generator

240v. AC power.
6 band. Accuracy 1 p.c.
120 Kc to 270 megs.
£19/15/0
Post, N.S.W., 7/6; Int., 10/.

G.D.O. ADAPTOR

For use with sig. gen. or mod. Oscillator.
Kit Set £9/10/
Wired and Tested, £10/10/

MULTIMETER

20,000 O.P.V. sensitivity.
Ranges:
DC volts, 0, 10, 50, 250, 500, 1000.
AC volts, 0, 10, 50, 250, 500, 1000.
DC current 0.50uA. 0.25, 0.500mA.
Resistance, 0.50K, 0.05 meg, 0.5 meg.
D.B. minus 20 to plus 36.

£7/19/6

MODEL K.2

2000 O.P.V. Sensitivity:
Ranges as above except 50uA.
£5/12/6
Post, N.S.W., 3/6; Int., 5/6.

METERS

Flush mounting.
1¾" moving coil. 1mA.
£2/5/0
0 to 50uA.
£4/15/0

STEREO PLAYER

4-speed.
£10/17/6
Stereo Changers, 4-speed,
£14/17/6
9V B.S.R. Transistor Stereo. Player.
£12/17/6

New Transporta 7

With R.F. stage. 1 Watt Audio.
Using drift type transistors.
Improved range and performance.
KITSET £25/17/6
WIRED and TESTED, £28/7/6.

MASTER ELECTRICS PTY. LTD.

A WHOLLY OWNED SUBSIDIARY OF MOTOR SPARES LTD.

LSG-100 LEADER SIGNAL GENERATOR

A smaller and amplified version of the Leader LSG-200, this generator is suitable for the amateur constructor and for all-round shop work.

Specifications:—

Frequency Range	400Kc to 36Mc 5 bands (Lowest is band-spread)
Calibration Accuracy	Within 1%
Output	High, Low and Fine
Internal Modulation	400 cps, approx.
External Modulation	Approx. 6 volts
Tube Complement	6BE6, 6X4
Power Supply	AC, 50 cps, 220V as specified 15 W
Size and Weight	6½ x 10 x 4½ inches
Weight	6lbs

Price £16 plus 12½% tax

£18 plus freight

PIEZO CRYSTAL MICROPHONES

MODEL BM3

(Illustrated). Response 100 to 8000 c.p.s. fitted with 6ft cable and phone plug with on-off switch. Can be used on stand or for hand use.

Price only 57/6

MODEL SM2

(Illustrated). Response 60-8000 c.p.s. fitted with 6ft cable and phone plug. This is a really versatile microphone, suitable for attachment to any stand.

Price only 45/

MODEL LM1

Response 100 to 8,000 c.p.s. Chrome-plated finish with 6ft cable. A very popular model.

Price only 25/

RECORD CHANGERS

RECORD CHANGERS AND PLAYERS

Extra special sale of brand new 4-speed Record Changers in original carton. Well known make complete and ready for installation, plays 7, 10 or 12 inch Records. **A real bargain at £9/19/6**

Record Changer as above but mixer type, very well known make, will give excellent reproduction of all types of records. Worth £20. **Our price £11/19/6**

RECORD PLAYER AMPLIFIER

Latest type English 4-speed record player with turnover head, pickup and two sapphire styli in handsome case finished in two-tone green, red or fawn. Amplifier has variable tone control, ideal for parties, dances, etc., also for music lovers. These are a really good buy for **£19/19/-**

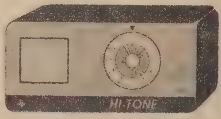
SPRING GRAMO MOTORS

Wind-up type, suitable for replacement in Portable Gramophones and also for hobbyist, complete with turntable and all fittings. **10/ ea.**
Sound Boxes:— for above spring gramo, **7/6**
Tone Arms:— for above . . . . . . **6/ ea.**

4 Speed Gramo Motors — to operate from 240 volt AC supply. Each has speed control knob for 16, 33, 45, 78 r.p.m. and also on-off switch. A good reasonably priced motor. English make, brand new and boxed. **Price only £4/15/**

4-Speed Gramo Motor with crystal pick-up, 2 sapphire styli, turnover head type, brand new and boxed. English make, will play all types of records except Stereo. **Price only £5/19/6**

All types of Stereo Record Changers, Players, etc., are available. Please write for particulars.



HIGH TONE TRANSISTOR MANTEL RECEIVER

Providing a good aerial and earth are used this set will work well up to 50 miles from a broadcasting station. It uses one transistor, one diode, has a 4in Rola speaker and works off a 4½ volt torch battery. 100ft aerial wire, 2 insulators and battery are supplied. These are brand new and boxed and Australian made. Worth £7/7/.

Our price £3/12/6

Write for your free copy of our latest Booklets on Tape Recorders and Testing Equipment.

TESTER BOY MULTIMETER

The Tester Boy Multimeter is ideal as a portable instrument for the hobbyist, motor mechanic, etc.

Dimensions are: 6in high, 2½in wide, 3½in deep. Weight 1lb 13oz.

Ranges as follows: Volts AC and DC, 2.5, 10, 50, 250, 500, 5,000.

Resistance: 0-10,000 ohms, 0-100,000 ohms, 0-4 meg ohm.

DC Current: 0-1, 10, 500 mA.

Decibels minus 20db to plus 10db to plus 22db. By referring to a chart up to plus 56db may be measured. The case is black bakelite with a metal panel 3in meter. Test leads are provided and also a leather carrying case. Sensitivity of the meter is 1,000 ohms per volt.

Price of this Unit £7/10/-

★ SPECIALS ★

1 **Record Player Cabinets only.** Durable coverings in variety of colours are available and these Units are suitable size to take any record player unit (not changer). Edges of case are reinforced with heavy beading for extra protection. Price of these is only 4/10/.

2 Crystal Earphones, stethoscope type. Ideal for crystal sets and all uses where a pair of high impedance phones are used. Brand new and boxed. **Price only 22/6 pair.**

3 High Impedance magnetic headphones, complete with phone cord. Brand new and boxed, 2000 ohms impedance. Worth 37/6 pr. **Our price 27/6**

4 **Single Crystal Earpieces.** Ideal for crystal sets, etc., with cord and plug. **Price only 11/6**

5 Single Magnetic Earpieces for use on all types of Transistor Portables. With cord and plug. **Price only 12/6**

6 Bargains in brand new Speakers, all guaranteed. 6in Permag with 3 ohm Voice Coil. 51/ reduced to **28/6.**
7 x 5in Permag with 3 ohm Voice Coil. Worth 52/6, reduced to **29/6.**

7 **Silicon Diodes.** Ideal for voltage doubling circuits as used in TV or Radio work. Also for rectifier replacements in AC and battery portables. Will operate on any current up to 400mA. Price only **13/6.**

8 **Illuminated Screwdrivers.** Metal body contains two long life torch cells and globe floodlights work. Four screwdriver bits are supplied with each kit. 2 Phillips and 2 standard types. All parts are in neat leather case. Extra good value at **16/ each.**

9 Transistors at new reduced prices:—

STC			
TS1		10	10
TS2		12	11
TS3		13	10
TS3Z		14	7
2N185	1	3	4
2N250	2	10	9
2N252	1	2	3
2N308	1	2	0
2N309	1	3	3
2N291	1	17	0

PHILIPS			
OC44	1	0	9
OC45	1	0	6
OC70		14	3
OC71		14	3
OC72	1	1	5

AWA			
2N370	1	5	2
2N371	1	5	0
2N372	1	5	0

AWA DIODES		
GEX 34	6	2
GEX 35	6	2

All makes of Diodes and Transistors stocked. Write for prices and information.

SPECIAL NOTICE

All parcels sent registered post unless otherwise stated. Postage or Freight must be included with order.

547 ELIZABETH STREET, MELBOURNE — Phone FY0271

BRANCHES THROUGHOUT VICTORIA AND RIVERINA

ON SHORTWAVE — By ART CUSHEN

English from Dominican Republic

Broadcasts in the English language are to be scheduled from the "Radio Caribe" station shortly.

THE station reports that these English broadcasts beamed to the United States, Scandinavia, South Africa and other areas of the world, are soon to be scheduled over Radio Caribe at Ciudad Trujillo in the Dominican Republic.

Radio Caribe has been on the air since last July, and has been well received in this area. The station plans to use 15055 and 9485 Kc for this foreign service. Broadcasts are heard here on HI4U 15055 and HI3U 9485 Kc, signing off at 4.00 p.m.; again from opening at 8.00 p.m., when the additional frequency of HI2U on 6210 Kc has been heard.

A new frequency, which is widely reported and which should give us reception this winter, is the HI5U transmissions on 3322 Kc, heard to closing at .00 p.m.

Two new frequency modulation stations H16U and H17U are also being announced as carrying the program, likewise a large network of medium-wave stations throughout the Dominican Republic.

Calls include HIU, the main station in Cuidad Trujillo. HIUA, HIUB. HIUC, HIUD, HIUE, HIUF; these are anounced, when the station closes.

We have been interested to hear one f these stations HIUD on 1400 Kc at .00 p.m.

Verification from the station has been received for the short-wave frequencies ver the signature of the President. J. Matti Ortero. The station announcement is "Radio Caribe, la voz de Antilla l Mundo."

As we go to press the station has been eard with English identification each 0 minutes, and states "This is Radio aribe broadcasting from the happy studios in Ciudad Trujillo capital of Dominican Republic."

RADIO NEW ZEALAND

RADIO New Zealand in Wellington has a new schedule now in operion, the main frequency change in the rvice to Australia being the replaceent of 9540 with 11780 Kc.

The complete schedule is as follows:—

Pacific Island transmission.

- 3.00 to 5.45 a.m. on ZL2 9540 Kc.
- 3.00 to 7.30 a.m. on ZL4 15280 Kc.
- 8.45 a.m. to 4.34 p.m. on ZL4 15280 Kc.
- 4.00 to 6.45 p.m. on ZL7 6080 and ZL3 11780 Kc.

Australian transmission.

- 6.00 to 8.30 a.m. on ZL3 11780 Kc.
- 8.45 a.m. to 3.45 p.m. on ZL4 15280 Kc.
- 7.00 to 9.45 p.m. on ZL7 6080 and ZL3 11780 Kc.

Antarctic Service.

- 6.15 to 6.45 p.m.

Sundays on ZL3 11780 Kc the programs from 3.00 a.m. to 3.45 p.m. are relays of the New Zealand Broadcasting Service Home programs.

The periods 4.00 to 6.45 p.m. to the Pacific and 7.00 to 9.45 p.m. beamed to Australia, are special overseas programs of Radio New Zealand.

ALGERIAN TRANSMITTER

A REPORT from Tamanrasset in Algeria states a new 20,000 watt transmitter built near a Sahara oasis will soon beam programs to French-speaking communities throughout the world. Tests are now going on and the regular schedules will commence soon to serve a world-wide audience. The French Government has spent £780,000 on this new station, in the 1961 French budget, to ensure it has the best of equipment and technical skill.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, N.Z. All times are Australian Eastern Time.

THE intense interest in African reception has been heightened by the good signals from many of these stations, and changes in the former Congo province of Katanga continue to be received. Radio Katanga advises that the new transmitter is of 100 Kw and not 50 Kw as previously advised. It is using 11865 Kc on a test basis. 2.00 to 10.00 p.m. and 2.00 a.m. to 7.00 a.m. The station has news in French at 3.30, 4.30 and 6.30 a.m., and a news session in English is read at 6.15 to 6.20 a.m. Station identification is "Ici Elizabethville Station de la Radio diffusion Independent Katanga." The relays of the Katanga home programs from Elizabethville in African language is now carried on 5952 Kc, 20Kw, 3.30 to 7.00 a.m.

SANTA ISOBEL ON 6240 Kc

RECEPTION of a new country is a rarity these days, but good signals from the African station in Spanish Guinea makes an easy addition to the log. First reported by Tony Ward, of Auckland, N.Z., this transmission from Radio Santa Isobel is heard on 6240 Kc and power is believed to be 1,000 watts. The station opens at 4.30 p.m. in a program of Spanish music. The station slogan is "Emisora de Radiodifusora de San Isobel," and the address is Box 195, Santa Isobel. Station operates from 4.30 to 5.30 p.m., 10.00 p.m. to midnight. 3.00 to 7.00 a.m. The station was formerly using 6160 Kc, but the higher frequency enables clear reception, though the signals from Budapest on 6236 Kc should not be mistaken for the African station.

SCHEDULES FROM NORTH VIETNAM

ACCURATE information on the broadcasts of North Vietnam radio in Hanoi have been difficult to obtain. but recently Radio Japan in its DX Session released complete details on the North Vietnam station.

The station uses 11840 and 9840 Kc. on the following schedules:—

TIME	LANGUAGE
9.00-9.30 a.m.	Laotian.
Noon-12.45 p.m.	English.
2.00-4.00 p.m.	In Cambodian, French, Laotian, English (30 minutes each).
6.30-7.30 p.m.	English news at dictation speed.
7.30-9.30 p.m.	Cambodian, Chinese, Cantonese.
10.00 p.m.-midnight.	Thai, Laotian, Cambodian, English (30 minutes each).
12.30-1.00 p.m.	Thai.
1.00-1.45 a.m.	Chinese, Cantonese, English, (15 minutes each).

Flashes from Everywhere

ENGLISH news broadcasts have recently been introduced on two Home programs of European stations. Radio Munich, which uses 6085 Kc has been reported with English news at 6.10 p.m. The Rome Radio transmissions have a special bulletin on the workings of NATO in its transmissions on 9710, 7270 and 5960 Kc. The broadcast in English is on the air at 3.10 a.m.

DAKAR in Senegal using 100 Kw is now on 15115 Kc in the transmission to Europe, which includes a bulletin of news in English, in the period 3.30 to 4.00 a.m. The local programs from Dakar are using the 25 Kw transmitters, and they are on 11895, 7210 and 4950 Kc.

TAIWAN in its service to this area is being heard on the new frequency of 7235 Kc from 8.05 p.m. This English transmission is also being carried on 6095 and 15235 Kc.

DENMARK in its transmission on Tuesday, Thursday and Saturday is noted on 15165 Kc, and has English from 7.00 to 8.00 p.m. The transmission has been heard in Australia, but signals are only poor and jamming is evident on the transmission.

MOZAMBIQUE has been noted on CR7BG and using the frequency 15145 Kc from 2.30 to 6.00 a.m. this transmission originates from the capital Lourenco Marques.

Make this stereo cost-test now!

Here's how to buy the ultimate in stereo equipment at less than kit-set prices. At Encel Electronics we insist that our prices are **impossible to beat.** You be the judge . . . here are a number of our complete stereo units . . . **the Encel packaged stereo deal.**

The new NS 2,000 "Nytone" amplifiers have now arrived in Australia. With harmonic distortion at 0.5 per cent output, 8 watts per channel and input sensitivity from 3.5 millivolts, these amplifiers are recognised by audio enthusiasts throughout the world. Detailed specifications will be forwarded on request.

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ANGOLA stations being heard include CR6RD on 4851 Kc to sign off at 7.30 a.m. Another is CR6RY and is heard on 4835 Kc. This Angola station closes at 8.00 a.m. with the Portuguese National Anthem and four-gong interval signal.

CONGO has been noted on the new frequency of 9700 Kc. Leopoldville transmissions have been noted in North America at 2.30 p.m. with a request session and news in French at the conclusion of that session.

GHANA noted on 15190 Kc and this test broadcast from Accra has been noted at 1.30 a.m., but signals in the North American area are poor.

DAKAR in Senegal has moved from 15456 Kc and is now on 15155 Kc, but mixed with the Ecuadorian signals of HCJB. This transmission from Dakar has been heard for listeners in Europe from 3.30 a.m., when English is among the languages used.

CANARY ISLAND station "La Voz de la Isle de las Palmas" is now using 7345 Kc. This drop in frequency has resulted in the reception of the signals in New Zealand in its second transmission. The complete broadcast schedule is from 10.30 to 1.30 a.m. and 5.30 to 9.00 a.m.

DEUTSCHE WELLE transmissions from Cologne show some alterations to frequencies in some transmission. Its service to Japan is now carried 7.45 to 10.45 p.m. using 17815, 21735 Kc. Service to Middle East is broadcast 10.45 p.m. to 1.45 a.m. on 17875, 21730. To Africa from 3.15 to 6.15 a.m. using 11895 and 15275 Kc.

TEHERAN in Iran has been making moves in the 41-metre band to find a new frequency. The transmissions still are the same, with its service to Europe, 5.30 to 7.00 a.m. made up of Persian, Russian (6 a.m.), Turkish (6.15 a.m.), French (6.30 a.m.), and English from 6.45 a.m. Frequencies of 7035 and 7045 Kc have recently been used in place of the announced 7285 Kc. The home programs for Iran continue to be heard on 9680 and 3750 Kc.

SOUTH KOREA relays the two Home programs from the HLKA transmitters in Seoul on the following schedule: First program in Korean 6.30 a.m. to 2.30 a.m. on 2510 Kc 10 Kw; 3910 Kc, 4 Kw; 5980 Kc, 10 Kw; 6035 Kc, 2 Kw and 7180 Kc, 10 Kw. The second program is on the air 6.30 to 9.30 a.m. and 7.00 to 4.00 a.m. using 11935 Kc, 50 Kw.

POLAND has followed the other European countries in introducing a service to Africa and the transmission from Warsaw is being broadcast in both Engish and French. The service is in Engish at 10.00 p.m., 11.00 p.m. and 8.00 a.m., and French at 10.30 p.m., 11.30 p.m. and 8.30 a.m. Poland uses 7125, 9675, 11800 Kc for the first two transmissions and then Warsaw can be found on 7315, 9540 and 9675 Kc for the last ransmission.

STANLEYVILLE in the Congo has been observed on 6045 Kc, and the period of transmission, according to a European listener, is from 4.00 and 7.00 .m.

ISRAEL, in its transmissions from Tel Aviv, has been noted on the new frequency of 11920 Kc with programs in French from 5.45 to 6.15 a.m., and in English from 6.15 to 6.45 a.m. This service remains on the old frequency f 9009 Kc also.

MOROCCO in its broadcast to Afrian listeners from Rabat, has a special service to the Congo, being now received on a new frequency. Rabat uses 15310 Kc for this session, broadcast on a daily basis from 2.30 and 3.00 a.m.

JAPAN uses the new frequency of 9740Kc. in its service to Europe in the second transmission. This broadcast is made from 5.00 to 7.00 a.m., and is also carried on 11800 and 6080Kc.

SOUTH AFRICAN signals are at their best this month and the more powerful Africa Service of the South African Broadcasting Corporation is now on the air according to the following schedule: 9.00 p.m. to 2.00 a.m. on 15235, 21495 Kc; 2.00 to 3.00 a.m. on 15300, 21495 Kc.; 3.00 to 6.00 a.m. on 15300, 17855 Kc. English is broadcast on Tuesday, Thursday and Saturday and Afrikaans on other days.

KABUL in Afghanistan is reported using 5010Kc according to Radio Japan, and it seems the frequency of 7250Kc has been replaced by this new outlet. Transmissions continue on 4710Kc. The station was heard with the English program from midnight to 12.30 a.m.; poor signals on 5010Kc are mainly due to interference from Standard frequency stations on 5000Kc.

TRANSWORLD RADIO continues to test from Monte Carlo and the latest frequency noted is 6120Kc. This transmission, giving good reception in the United States, has been heard from 5.30 to 7.30 a.m. They request reports on reception to Box 141, Monte Carlo, Monaco.

SHORTWAVE Listeners Corner, the B.B.C. program which gives news on shortwave topics, is now carried in the Pacific Service on Sundays. The Pacific service is scheduled to be re-timed to its winter transmission period of 4.00 to 5.00 p.m., and it is expected it will be programmed in that block. Present frequencies in use to Australia and New Zealand are 9510, 11750 and 15375Kc.

The program is also carried in the General Overseas Service from London and is heard on Wednesday at 10.15 p.m. and Thursday at 11.15 a.m.

PERTH. Western Australian schedules were recently broadcast in the Melbourne DX session. The two transmitters are VLX 10Kw and VLW 2Kw.

The Perth transmissions are: Sunday to Friday, 8.30 p.m. to 1.30 a.m., and 8.00 a.m. to 10.00 a.m.; Saturday, 8.30 p.m. to 2.00 a.m.; Sunday, 8.30 to 10.00 a.m. on VLX9 9610Kc, and VLW6 6140Kc. Daily from 10.15 a.m. to 8.15 p.m. on VLX15 15425Kc, and VLW9 9610Kc.

WEST NIGERIA, which is being heard on 4855Kc is reported to be making some frequency changes, and moving this transmitter to 6185Kc. A new transmitter is to be brought into operation on 3380Kc.

KATANGA had a new 50Kw transmitter put into service by President Tshombe of Katanga. The service is on 11866Kc the transmission being on the air from 2.00 to 10.00 p.m. and from 2.00 to 7.00 a.m., with news in French at 4.30 and 7.30 a.m.

NEW YORK station WRUL in the broadcasts to Europe, is using the frequencies of 11790, 17750 and 15380Kc. The 11830 channel has been replaced by 11790Kc; English is noted at 7.00 a.m.

BELIZE in British Honduras has been noted in North America on 3300Kc with relays of the Voice of America news 7.00 to 7.15 a.m., in English. This transmission is from the British Honduras colony.

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ANSWERS TO CORRESPONDENTS

MEASURING MICROPHONE RESPONSE

D.B. (Croydon, S.A.) asks how it is possible for the frequency response of a microphone to be measured, when according to his reasoning, a speaker whose response is known must be used. Similarly, he reasons that a calibrated microphone would be required to test a speaker. Which came first? He adds hat he prefers our magazine to most American publications in all points other han paper quality.

A.: You are right, D.B., in supposing hat a calibrated speaker source is required to test a microphone. A calibrated microphone is also needed to test a speaker. How did it all start? Well, here is one possible way at least. This s to use three microphones in a series of tests, in a special soundproof chamber, alternatively using each microphone as a speaker. The test relies upon the fact that the response of a microphone at very low power levels as a speaker is the same as its response as a microphone. From the results of the three tests, the response of each mic. can be extracted by calculation.

The quality of paper used in any publication and the general quality of printing is a matter of economics. There is virtually no limit—if you can find someone to pay the bill! The rotogravure process we are using at present represents a big improvement on the original method and compares favourably with other Australian magazines working to a comparable budget.

H. L. B. of Highett, Vic. says he has built the R. TV and H. Wide Band CRO and wonders whether it could be used for the analysis of ignition performances n motor cars.

A. We are glad to see that the CRO urned out to be so successful. We have no intimate knowledge regarding the use of such instruments for motor car ignition testing, although we did reprint an overseas article a couple of years ago. We would probably find that a good deal of adaptation would need to be done and, just at this moment, we cannot see our way clear to tackling the proposition.

J.G. of Mitchelton, Qld. says he contructed the "All Wave Transistor Set" rom the June 1960 issue.

A.: Thank you for your letter and we re glad to see that you have been able o log so many stations on the broadast band and on the 4-12 meg. coil. ou seem to have done very well also ith the other small sets. Nice going.

A.R.W. (Ashgrove, Qld.) says he is ne of our younger readers and would elcome an article on a tape recorder nit to work with Playmaster equipment.

A.: Thank you for your letter and for our appreciative remarks. By this time ou will have seen our Playmaster Tape daptor which was actually in course construction when your letter arrived. e note also your interest in the subct of Pipe and Electronic Organs.

R.C.W. (Epping, N.S.W.) writes to us ith an alternative suggestion for the libration circuit for the New Standard RO for 1960. He suggests that we conct a 3 megohm resistor in series with e filament supply in order to produce volts for the calibrate voltage. Thus, ing the vertical scale described, 1 volt, a multiple, would equal one division d the use of the facility would be nplified. RCW also sends some details the vertical amplifier in the CRO nich he is at present building. The in is controlled by varying the negate feedback applied over a portion of e amplifier and preliminary tests seem indicate that the system will work ll.

A.: Thank you for your remarks and ggestions about the "New Standard CRO". Unfortunately Mr Barker, who prepared the original article, is no longer on our staff, so that we cannot refer the matter directly to him. In regard to the amplifiers, the type you suggest should be quite effective although not necessarily a better proposition overall than those suggested in our article.

T.E.R. of Seaford, Vic. says he has been a radio fan since 1921, but has also had a lot of experience with reed and pipe organs. He remarks that the articles in May, June and October, 1955 issues should be of assistance to anyone looking for an introduction to the general subject of organs, electronic and otherwise.

A.: Thank you very much for your letter and for your interesting remarks. The "player" type pipe organ which you describe must have been quite a fantastic instrument. We have never seen anything personally quite like it.

V. H. R. of Pascoe Vale, Vic., writes to comment on the October issue. He says that he appreciated the "Amateur" articles, and also the one on the Bering Dam Scheme, as an example of potential international co-operation.

A.: Thank you for your letter and your appreciative remarks. Sorry that you did not like Calvin Walters' effort to the same extent, but there are probably others who would have done so. The fact that Calvin has been writing for us without interruptions since 1939 is an indication that many readers like his particular mixture of information, common sense and tomfoolery.

K. A. D. (Harbord, N.S.W.), asks if we have ever described a six inch TV receiver, and if so, in which issue it appeared.

A.: We have published two six inch TV sets, K. A. D., latest version being the "1958 TV Receiver adapted for Six inch Tubes" of August 1958. This issue is still available via the Back Number service, at a cost of 2/6.

RADIO, TELEVISION AND HOBBIES QUERY SERVICE

TO assist our readers, "Radio, Television and Hobbies" conducts a technical query service. Conditions governing this service are set out below:—

(1) Requests for copies of circuits or technical queries requiring an answer through the post must be accompanied by postal note or stamps to the value of TWO SHILLINGS. Queries not accompanied by a fee will be answered in rotation on these pages.

(2) For the 2/ fee, we will supply circuit data, as available, for up to three projects. The amount of data available varies, but in no case can it include information additional to that already published in the magazine. As a rule, requests for circuits will be answered more speedily if they are clearly identified and not complicated by questions requiring the attention of technical personnel.

(3) The technical query service is aimed primarily at assisting readers in matters relating directly to articles published in the magazine. Answers will be given in note form and only so far as can be drawn from general knowledge of the relevant subject. We cannot provide lengthy answers, undertake special research, discuss commercial designs or draw special circuits.

(4) The Editor reserves the right to return query fees or to limit the scope of an individual reply, where it is felt that a partial answer will be better than none at all. Please note that the inclusion of an extra fee does NOT entitle correspondents to special consideration.

(5) In addition to the normal query service, chassis blueprints are available for most of our projects, showing the position of all holes and cutouts for metal-working but containing no details of wiring, etc. Apart from complicated projects like TV sets and oscilloscopes, most blueprints cost 5/ each. Original photographs of most projects are also available, from 5/ for a 6in x 8in glossy print; postage 9d extra.

(6) Letters should be addressed to the Technical Editor, "Radio, Television and Hobbies," Box 2728, G.P.O., Sydney.

(7) "Radio, Television and Hobbies" does not deal in radio components nor will we debate the relative merits of competitive products. Prices and specifications of merchandise must be obtained from our advertisers.

(8) Technical queries are not answered by telephone.

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ANSWERS TO CORRESPONDENTS

S.S. (Merlystone, Vic.) sends us some queries regarding terms used to explain waveforms, ringing and overshoot. He adds that he appreciates articles on photography and hopes that we may be ble to include more in future.

A.: The explanation of the terms menioned would require a lot of space and ime, S.S., so we will file the query away or future use in the "Here's Your Anwer, Tom," section of the magazine. We re aware that many readers are intersted in photography, and will endeavour vhere possible to include articles of inerest in future.

J.B. (Camberwell, Vic.) asks if we ould advise whether a 2N1107 transisor can be substituted for the 2N372 sed in the "All Wave Transistor Set" of une, 1960.

A.: Sorry, J.B., but we have no inormation on this transistor. However, ve would suggest that you test it with multimeter to make sure that it is a PNP type, and then simply try it in the ircuit. If care is taken, no damage hould result from this procedure.

H.H. (Ravenhoe, Nth. Qld.) offers the uggestion that we publish details of a igh performance receiver for country isteners who are situated in fringe areas. He includes suggestions for the form uch a receiver would take, and gives an dea of the problems involved in his paricular area.

A.: We too think this would be a good dea, H.H., and although we may not e able to feature such a design for some ime yet, will keep the idea seriously in nind.

RECORD REVIEW

(Continued from Page 107.)

Consecration of the House, Op. 124. Played by the Philharmonia Orchestra, conducted by Otto Klemperer.

Your preference for one of these two ne performances of the Fourth Symhony is likely to be purely temperaental, for, though the Coronet has the dvantage of fine stereo, the Columbia ono is excellent, and a stereo version ill no doubt follow in a few months.

It would be difficult to imagine two ore different, yet persuasive accounts f the same work. Klemperer concenates on the essential solidity of Beeoven's structure, though this pursuit ever betrays him into stolidity. Morever, there is throughout his reading at great forward drive in the music hich characterises everything he plays.

Walter's interpretation is much more Viennese"—lighter in texture, graceful phrasing, and essentially lighthearted roughout. And he, in turn, brings l this off without trivialising the true mphonic proportions.

I was, however, disappointed in alter's companion piece, the Fifth. It surprisingly deficient in all those alities one usually finds in Walter's ork—lyricism and ardour among them. the other hand, Klemperer offers as e a performance of The Consecration the House as I have ever heard. her on disc or in the concert hall.

Perhaps it might be as well to wait til the stereo Klemperer is issued beire you decide.

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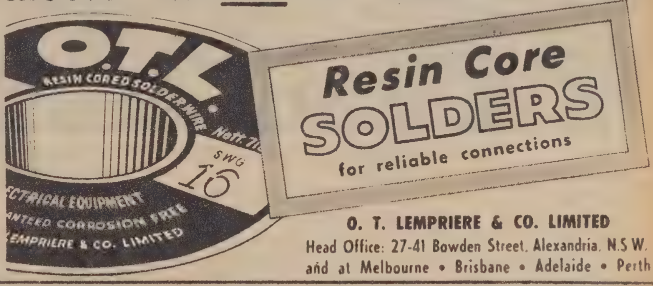

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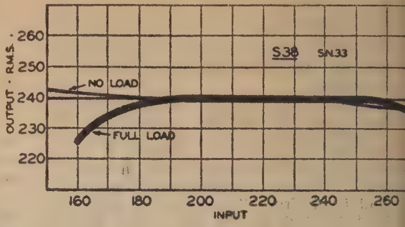

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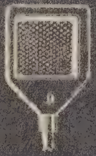

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Try it some time. Concentrate intently upon another person seated in a room with you, without his noticing it. Observe him gradually become restless and finally turn and look in your direction. Simple—yet it is a *positive demonstration* that thought generates a mental energy which can be projected from your mind to the consciousness of another. Do you realize how much of your success and happiness in life depends upon your influencing others? Is it not important to you to have others understand your point of view—to be receptive to your proposals?

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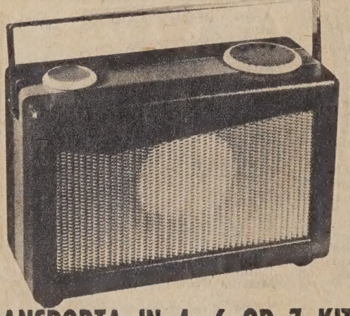

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Bacteria — good bad, indifferent

(Continued on Page 19)

cked in barrels with plantain leaves a few days.

Liquefaction of the mucous covering the bean takes place due to bacterial ion, with the formation of alcohol l acetic acid. When the process is mplete, the beans are removed and ed, whereupon the tannin contained them oxidises and gives the familiar wn colour.

Leather owes its durability to micro- l action. Sometimes hides are stripped hair and flesh by a decomposition ion of microbes but nowadays this is ne mechanically. At one stage lime is d in the process. To get rid of this e the hide is placed in a bath of n. Here lactic acid is produced by crobial action. This unites with the e to form calcium lactate which is uble in water and readily washed ay.

NNING HIDES

Subsequent tanning of the hide takes ce in pits where the hides are laid, arated by tan bark mixed with water. uring of the liquor takes place by crobial action. The souring helps the nin to be removed from the tanbark l also in the combining of the tannic d with the hide gelatin, a process on ich depends the durability of the shed leather.

Smokers will be interested to know t germs play an important part in viding quality and aroma to their acco. During the curing process at emperature of 50 degrees Centigrade leaf "sweats," whereupon certain teria including our friend Lactoba- us take a hand on the sugars in the f to bring about certain beneficial nges which influence the quality of finished product.

The manufacture of vinegar requires ohol, oxygen and acetic acid bacteria. alcohol is obtained from cider or er fruit juices. The acetic acid bac- a is obtained from "mother of vine- " and the oxygen from the air.

CID BACTERIA

container of shavings is first charg- with acetic acid bacteria by putting mother of vinegar into them. Shav- are used because they expose the imum of surface to the air. A dilute tion of cider or other suitable alco- containing liquor is sprayed over the ings. It trickles to the bottom, con- ing the bacteria and oxygen from air on its way down. When it hes the bottom it is vinegar. All is automatically controlled so that proper time is taken for the pro-

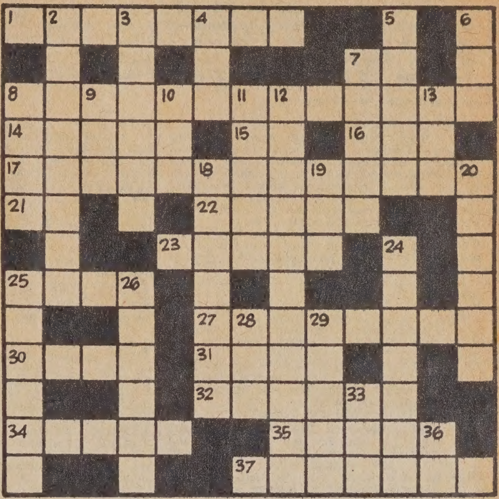
the manufacture of linen the essen- fibres of flax must be separated the stalks. The easiest way to do is to spread the flax straw over the nd after wetting with water. robes take charge and decompose tissues of the stalk in which the s are embedded. The fibres are then y removed.

e could talk about the microbes in the ground which assist in the growth of plants or those which are used in the manufacture of alcohols and acetone from sugar cane. We could mention the bacteria which make atric, oxalic and gluconic acid. We could talk about the manufacture of acetone and butyl alcohol from poor grades of corn and molasses.

More could be said of how microbes form butyl alcohol from starch, to be used in making artificial rubber. Then, of course, they help dispose of sewage in septic tanks.

All of which shows that microbes play a far more important part in our lives than producing disease.

THE R., TV & H. CROSSWORD No. 83



ACROSS

1. Carrier frequency amplifiers.
7. Preposition.
8. Silent connector.
14. Sydney/London liner.
15. There.
16. Greek letter.
17. Aussie exclamation.
21. Therefore.
22. Bellows.
23. Downcast and quiet.
25. Rhythm.
27. To oppose the passage of electric current.
30. A point on a conductor at relative zero voltage.
31. They're hep.
32. Cavalrymen.
34. Additional.
35. Voice.
37. Part of a house (abbrv.).

DOWN

2. Harmonics of sound frequencies.
3. Not very long.
4. Make a mistake.
5. Phrase representative of a family.
6. Tree.
7. Layers.
8. Low growth.
9. Spanish for river.
10. French figure.
11. Animal created by Jonathan Swift.
12. Descriptive of currents which continue without change.
13. Bird cry.
18. The hot latitudes.
19. Weep.
20. Type of circuit in which the current flows through all components.
24. Union.
25. Type of coil winding in which successive turns are laid up into layers.
26. Speculation as opposed to practice.
28. Sleep.
29. He carries a torch.
33. Girl's name.
36. Letters on rubber cheques.

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